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## Technique of Materials Handling

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## Soluble Salts as Flotation Reagents

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## Contents for December 14, 1929


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**Editorials** ..... 913

EDUCATORS and Industrial Leaders Act to Protect Future of Mining . . . Helping to Suppress Tuberculosis Is More Than a Duty . . . Rebuilding a Plant Permits Remodeling the Process . . . Water Divining Easier Than Mineral Divining . . . Recent History of Copper and Future Prospects.

**Sources of Alaska's Mineral Wealth** ..... 916

ILLUSTRATIONS

**Technique of Materials Handling Deserves Increased Consideration** .. 918

C. H. McL. BURNS

**Soluble Salts as Flotation Reagents** ..... 920

NEVIN HAL McKAY

**Why Hand Drilling Was Abandoned at Almaden Quicksilver Mines** .. 922

**Calcined Vermiculite as a Plaster Base** ..... 923

C. S. CROUSE

**Mining and Processing Silica at an Arkansas Property** ..... 925

H. R. McKNIGHT

**Mining in Western British Columbia** ..... 926

F. H. MASON

Comment and Criticism .. 928
Digest of Current Literature ..... 931
Useful Operating Ideas .. 932
Personal Notes ..... 935
Obituaries ..... 935
Mining News ..... 936
Market and Financial News ..... 944
Metal Price Curves ..... 945
*E. & M. J.* Statistics of the Mining Industries 947
Market Report ..... 948
Mining Stocks ..... 950
Service Directory ..... 49
Searchlight Section ..... 50
What and Where to Buy ..... 54
Advertising Index ..... 58



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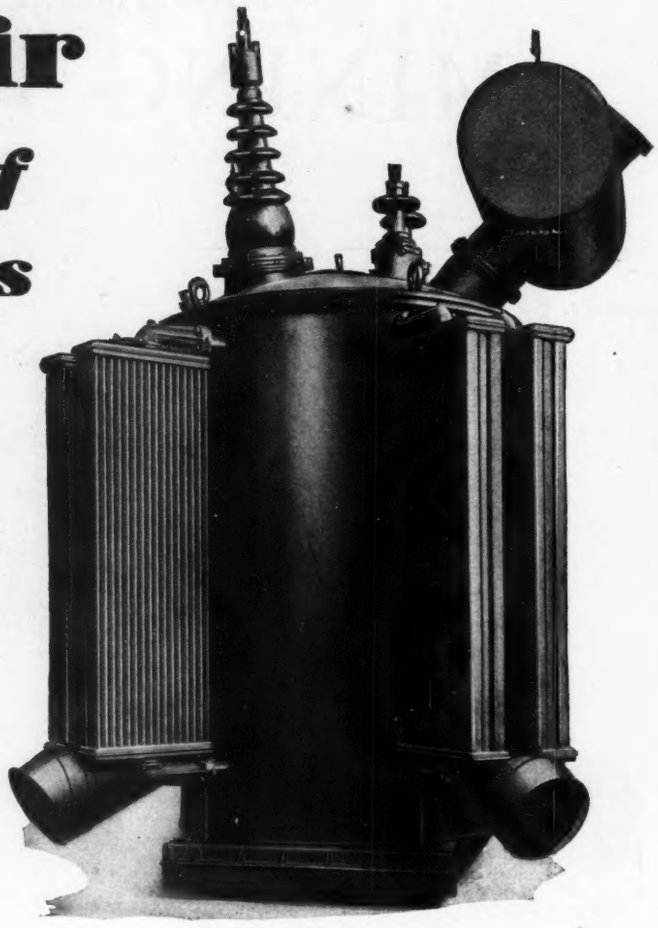
# Forced Air Cooling *of* *Transformers*



5000 KV-A 115000 Volt self cooled transformer with forced air circulation built for the Carolina Power and Light Company.

SOME of the latest developments in power transformers have been in the systems of cooling. As the capacity of a given transformer varies with the amount of heat dissipation, it is important to select transformers that have efficient cooling.

The transformer shown above has a rating of 3333 kv-a. with natural cooling only. With forced air circulation it will carry 5000 kv-a. with 55° C. rise. This is accomplished by small fans which blow air up between each pair of radiators. The operation of these fans is automatically controlled by the temperature of the transformer. Fan motors are arranged for conduit wiring.

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ENGINEERING AND
MINING JOURNAL

A McGRAW-HILL PUBLICATION A. W. ALLEN, *Editor* ESTABLISHED 1866

VOLUME 128 New York, December 14, 1929 NUMBER 24

## Educators and Industrial Leaders Act to Protect Future of Mining

EARLY this year, *Engineering and Mining Journal*, in commenting on the results obtained from a survey of enrollments at the various mining schools of the country, directed attention to the fact that if the mining industry were to obtain the best young men of the country, and in sufficient numbers, inducements to the prospective undergraduates to enter the field of mining engineering should equal those offered by the other engineering professions. The survey indicated that the number of young men graduating in mining engineering in the next few years from the educational institutions in the United States would total about two hundred annually. Serious consideration of the situation on the part of the industry, mining educational institutions, and affiliated agencies was obviously advisable.

In the interim, since the publication of the results of the survey, a few measures directed toward betterment of the conditions then prevailing have been undertaken. Both educators and mining executives have assembled on various occasions to discuss the subject and to draw up plans for remedial action; national organizations within the industry, by directing the attention of their members to the problem, have aided materially in bringing about widespread consideration of the situation. Although immediate increase in enrollments in mining courses could not be expected, a trend in this direction in the next few years seems assured if current efforts toward that end are sustained. Enumeration of all the activities that have been undertaken or are now in progress with this object in view is impossible here. However, two recent developments, in exemplification of much similar endeavor, may well be referred to.

At the dedication of the new John Markle Mining Engineering Hall at Lafayette College last week, President William O. Hotchkiss of the Michigan College of Mining and Technology said in his dedicatory address: "The leaders of the next generation will start with the handicap of industries already vast, without the opportunity of growing with these industries from small beginnings. The leaders of the future will to a much larger degree be college-trained men, because a much larger part of our young men of great native ability are in college than was the case a generation ago. This presents a challenge to the colleges which we of their faculties are bending our best efforts to meet. This great industrial development has been so unprecedented that college faculties can know only imperfectly what should be done to prepare these new leaders most adequately for their tasks."

Surely, this is a frank statement that reveals the well-defined understanding the educators have of their share of the general problem, as well as their willingness to co-operate fully with industry. These facts were more forcibly evident the day following the dedication, when industrial representatives and educators spent an entire morning in conference discussing the relation of mining education and industry. Of similar significance is the action of the mining industry of Utah in offering cash and scholarship awards to the high-school and college students of the state. In this instance, the larger mining and smelting companies in the Salt Lake valley jointly established the awards, with the evident intention of focusing the interest of the youth of the state on the opportunities in the mining industry of Utah and its economic importance to the state and nation.

Mining is in competition with the other industries for capable youthful talent to conduct its affairs in the future. Granted a continuance of the increasing interest in the subject that has been apparent during the current year, the outlook for an adequate supply of well-equipped staff personnel should improve materially.

## Helping to Suppress Tuberculosis Is More Than a Duty

MINING has its particular health hazard, in common with many other industries, and no advantage can be gained by ignoring the fact that tuberculosis, acquired underground or in surface plants where dust is not being allayed, is a cause of preventable disability and mortality. Vigorous combative and educational measures are taken by the leading mining companies, with excellent results; but the parish of *Engineering and Mining Journal* covers a multitude of properties where the risk is recognized but where no vigorous corrective action is taken. The "skeleton in the cupboard" is left alone, ignorance of simple truths prevails, and the result is misery, suffering and financial loss to all concerned.

In the extent of its ravages on humanity, no other ailment has been reduced by the persistent dissemination of educative propaganda to such an extent as has tuberculosis. Research and medical science have combined to simplify diagnosis and treatment, and no serious illness is more amenable to care and attention. The amazing fact persists, however, that the individual whose health and happiness are threatened fails too often to heed the warnings of approaching trouble. The early symptoms in most instances are unmistakable, but often indiscernible to close friends and relatives—an inexplicable fatigue, loss of body weight, and a persistent though per-

haps insignificant cough. A cure is almost certain if early precautions are taken; and no remedial action is too drastic if this can be effected.

In its campaign against phthisis, the National Tuberculosis Association has met with signal success, as statistics indicate. But it cannot seek out incipient invalids. To them and to executives who have the health of their employees at heart we suggest that advantage be taken of the excellent advice contained in circulars and pamphlets obtainable on request from the Association's headquarters at 370 Seventh Avenue, New York City.

As the Christmas season approaches we shall be reminded to use the Association seals on our letters. Funds are needed, and a generous response from all mining men should be assured. To assist in the suppression of tuberculosis in the mining industries is more than a duty.

## Rebuilding a Plant Permits Remodeling the Process

THE recent destruction of the mill of Dome Mines, in the Porcupine district of Ontario, draws attention to the fact that metallurgical opinion as to the most economical and most efficient treatment of the gold ore of the district has not been unanimous. Contrary to majority viewpoint on the subject, Dome retained the practice of milling in alkaline water and amalgamating the crushed ore prior to cyanide treatment, with excellent results. Elsewhere in the Canadian gold fields, however, amalgamation was looked upon as technically inadequate and economically impossible. This attitude was due in large measure to the outcome of an attempt to apply a continuous recovery amalgamation process at another Porcupine property, despite the fact that neither the literature of the subject nor the experience of amalgamators had developed any efficient method of applying the principle in practice.

However, an extensive trial was made. Concentrate assaying from $350 to $400 per ton, obtained by the operation of Deister tables on an ore from which a high recovery of gold had previously been reported by the use of plates, was shoveled into grinding pans, which discharged into settlers, from which a continuous stream of mercury flowed to amalgam safes, being strained en route through canvas bags. The amount of mercury in the circuit amounted to one and one-quarter tons. An anticipated clean-up of $40,000 resulted in a yield of $9.50, whereupon amalgamation was discarded and discredited.

As a matter of fact, all that the experiment proved was that still another continuous recovery amalgamation process was impracticable. The outcome of this failure was that the resultant general condemnation of the amalgamation process served to deflect attention from the advantages of preliminary impoverishment of a gold ore before cyanidation—another highly controversial point. But in abandoning amalgamation the trend developed in the direction of fine grinding, then superfine grinding, in cyanide solution.

Those who criticized this tendency were very much in the minority, but one article appearing over twelve years ago discussed a case in point afforded by the publication about that time "of the result of treatment in a milling in cyanide plant where amalgamation has been abolished. Previous milling operations showed that 86 per cent of the gold could be concentrated in about 7 per cent of the tonnage. Tests on the 93 per cent remaining, constituting the tailing after amalgamation and concentration, showed that this could be reduced to 45 cents per ton by crude cyanide methods, and apparently without further grinding expense. The 45-cent residue, however, was considered discouraging, and further experiments on a sand of normal fineness for leaching purposes were apparently not considered. Tests were then made to see how much gold could be dissolved by an agitation treatment, and the result indicated that all the gold was soluble provided grinding was carried far enough. 'Extractions' of 99.7 per cent were obtained in the laboratory; and as a result of these tests it was decided to grind and re-grind the 7 per cent of the concentratable material without separation from the 93 per cent of low-grade ore, a scheme which provided that every particle of worthless rock and absorbent colloid should be thoroughly accepted in as rich a solution of gold as possible."

Much slimed ore has gone to the dumps since this method of treatment was adopted, and many lessons have been learned, particularly in regard to the surface-tension effects of excessively fine grinding in an aurocyanide solution, and the insoluble nature of the gold thus adsorbed. The new Dome Mill will in all probability operate under a new flow sheet, and interest is already being evinced as to the probable trend of design. *Engineering and Mining Journal* ventures to suggest that preliminary impoverishment, by amalgamation or concentration or both, is a sound principle to consider. Super-fine grinding of the raw ore in cyanide solution does not always bring the economic and metallurgic results that are indicated by laboratory testing. Moreover, the regeneration of cyanide in waste solution is making headway as an efficient and economical process. The thickening of slimed ore, so that a product contains only a small percentage of moisture, is now practicable at a low cost. A major objection to milling in alkaline water no longer exists.

## Water Divining Easier Than Mineral Divining

AN EXHAUSTIVE STUDY of the divining rod and its application has been made by Dr. J. W. Gregory, of Glasgow University. He says that the existence of water nearly everywhere, at slight depths, with seldom a clew to aid in finding it, is the basis for the widespread faith in the divining rod. An interesting study published in the Annual Report of the Smithsonian Institution concludes thus: "The survival of the use of the divining rod in the search for water after its many other uses have been abandoned is, in my opinion, because shallow supplies of water are scattered abundantly but so irregularly and elusively that discovery is often a matter of chance. Some observers are especially quick in detecting faint clues, and in the areas where diviners are mostly used a large proportion of successes is inevitable, owing to the wide distribution of underground water."

The odds, according to Dr. Gregory, are in favor of the water diviner. If mineral deposits were as plenti-

fully distributed as is ground water one might well infer that the mineral diviner would also have been successful enough to have established his calling as a profession. The mineral industry, like agriculture, would then have been on a co-operative marketing basis, directed by a federal commission. But the odds are not on the side of the mineral diviner. His scientific relative, the geophysicist, has the important advantage that he is a measurer of physical properties. When he has mastered their intricacies his conclusions are of value. His calling is established and he is becoming of useful diagnostic help in unraveling geological problems and in finding some types of ore deposits. Nature interposes many obstacles; but, if man observes closely and studies hard enough, many of the hidden deposits will be found.

## Recent History of Copper and Future Prospects

TWO years ago the Copper Institute was formed "to further the interests of the copper industry," to quote from the preamble to its constitution. Essentially, it sought to do this by disseminating information regarding production, sales, costs, and other data that would give its members a true picture of the current situation as to production, but without revealing the individual position of any member, and without obligating him to conduct his business in any way other than as he wished. The Institute sought to follow the lead of other trade associations in collecting data germane to its industry, in the hope that more intelligent production and marketing practices would result, without conflict with the federal anti-trust laws.

Neither price nor production, so far as the domestic market is concerned, can be controlled except by an individual member in his own interest. In the export market such is not the case. To a large extent, the same members that comprise the Copper Institute also constitute the common foreign sales agency, Copper Exporters, Incorporated, which has power to allocate the amount of copper distributed in the export field and to fix the price at which it is sold. Naturally, in a commodity like copper, in which a large proportion of the United States production is sold abroad, the foreign price must bear a definite relation to the domestic price, or *vice versa*. If a producer is able to sell a part of his production abroad at a legally maintained and satisfactory figure, he is justified in taking every advantage of this avenue for the absorption of excess output, and of operating in conformity with the laws of the United States.

When the Copper Institute was launched the price of copper was about 13¼ cents, which was lower than it had averaged for the two years immediately preceding. The expectation was generally held that the Institute would stabilize copper prices at a level that would mean a reasonable return to producers. As 13¼ cents did not assure a fair profit to many of them, observers expected that the price would be raised and that subsequent fluctuations would not be severe.

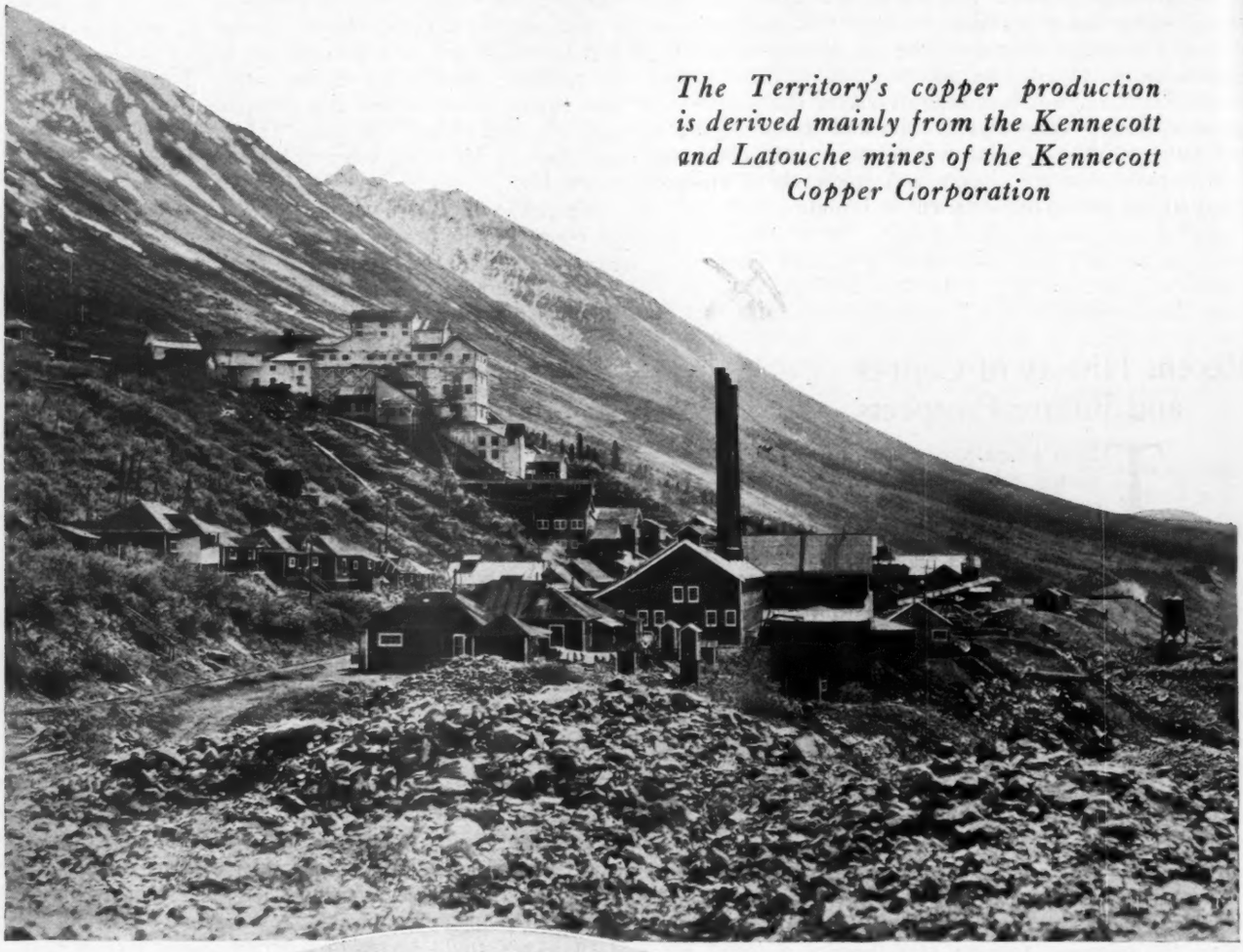
As the price level gradually advanced in 1928, therefore, the Institute was in process of justifying itself. Naturally, some disgruntlement was evident abroad, most of which came from dealers whose operations had been curtailed by the increasing influence of Copper Exporters, and who had less opportunity to manipulate the price. Complaint was also made by consumers, domestic and foreign, as the price gradually rose. The essence of these complaints was that, instead of promoting stability, the closer co-operation of the producers was merely resulting in raising prices. However, part of the plan of the Copper Institute was to rescue the industry from the disadvantages of a 13-cent market, so the gradually increasing price was not unwarranted. The climax came last spring when sellers and consumers ran amok temporarily and chased the price from 18 cents up to 24 and back to 18 in the interval between February 23 and April 15.

Since the middle of April, 18 cents has been the price of copper. The producers held fast during the long lull in demand in May, June, and July, despite efforts of some consumers to force concessions; and when a wild demand manifested itself on that memorable September 3, the price still rested at 18 cents, notwithstanding efforts of some producers to get more. Armed with the data of their trade association, enough producers evidently felt and still feel that 18 cents is a just price. Buyers may be holding off, hoping for concessions, but no evidence is available to show that any lower quotations are in the offing. Rather is proof at hand that most producers are regulating production to meet expected demand, hoping that others who prefer to run their plants to capacity will not output copper in quantity sufficient to disturb the market.

Several other factors might upset the price, of course. So many producers outside the Copper Institute may come to the front before long that continued effort of Institute members at major curtailment may prove unwise. Another factor is that of substitution. Without doubt, a rise of five cents in the price of copper in an interval when a slight reduction has been made in aluminum, an important reduction in tin, and when other metals have been stable, has led to some substitution, even though it has been more than offset by increased uses. Should substitution assume significant proportions, a lower price for copper might be good business. A third factor might become important should the attitude of the United States government change in regard to price stabilization. No matter what the price of copper is, the government might offer objection to an unvarying figure, even though no obligation rested on anyone to maintain it.

Altogether, one may look on the last two years as highly successful. Though some complaint is heard, producers and consumers are apparently both well satisfied with present conditions. As for the ultimate consumer—you and me—the increase of five cents in the price means but eighty cents a year to us apiece, assuming that we each get our share of the sixteen pounds which is the average consumption annually per person in the United States. Finally, one should remember that the cost of copper production commonly reported, say about eight or nine cents for some companies, is usually an operating cost only, and that many other expenses must be met by the mining company. Heavy outlays have been made and still heavier ones must be anticipated to insure for underground workers conditions as healthful as obtain in the average factory on the surface. A copper mine is a wasting asset. The product, on the other hand, is of great durability. It possesses unusual resistance to corrosion. It is of high intrinsic quality. Its cost, at eighteen cents per pound, is comparatively low.

# SOURCES OF ALASKA'S



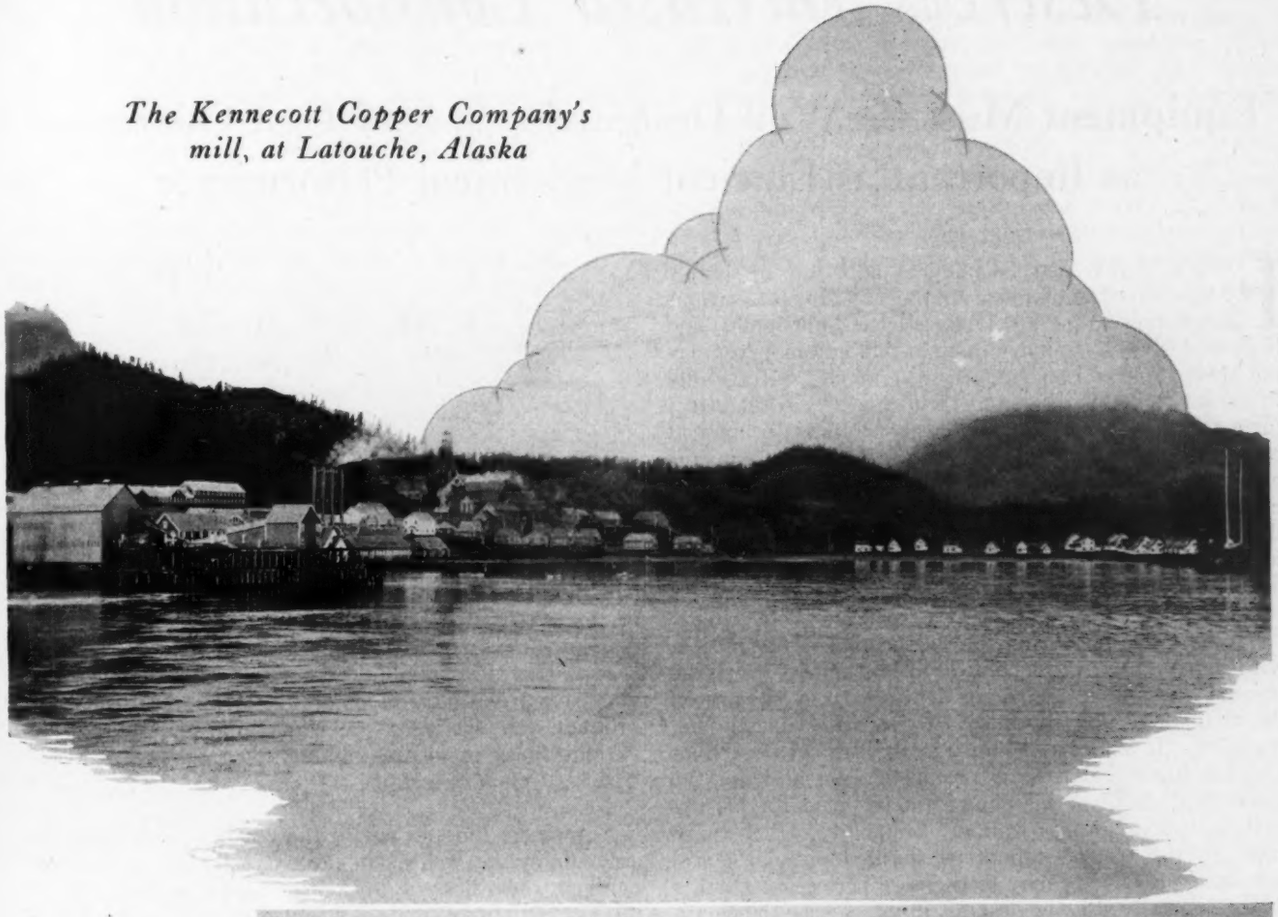
*The Territory's copper production is derived mainly from the Kennecott and Latouche mines of the Kennecott Copper Corporation*

*Above—Mill of the Kennecott Copper Corporation, Kennecott, Alaska*

*Left—A hydraulic Giant in operation, near Chatanika, Alaska*

# MINERAL WEALTH

*The Kennecott Copper Company's mill, at Latouche, Alaska*



*Right—A belt-conveyor loader employed by the Kennecott Copper Company at Kennecott, Alaska*

# *Technique of Materials Handling Deserves Increased Consideration*

## Equipment Must Be Well Designed .... Low Cost Operation as Important as Efficient Mechanical Performance

C. H. McL. Burns
*Copper Cliff, Ontario, Canada*

EFFICIENT and economical adoption of highly specialized equipment to the handling of various materials, ranging from electric-light bulbs and high explosives to foundry castings and automobiles, may not seem to offer much that can be applied successfully to mining, but this development in the field of manufacturing has made better materials-handling equipment available to the mining industry. The great impetus given materials-handling methods by the growth of manufacturing, the diversification of its problems, and the high standard of equipment demanded, have resulted in a new point of view on the part of the equipment manufacturer and have led him to greatly improve his product.

Modern manufacturing, in its phenomenal expansion, with its enormous production problems and its insistence on efficiency and economy, has demanded and encouraged the technology and ingenuity of the materials-handling engineer. It has forced him into the field of economics and has insisted that he is responsible not only for the mechanical detail of his equipment but also for its efficient and economical operation. Suitability of the equipment to the service cannot be decided on mechanical details alone. There may be a choice between a number of mechanically suitable designs, in which case the equipment requiring the least capital expenditure and having the lowest costs in operation is the most suitable. Modern manufacturing has produced a specialist in the materials-handling field who is commonly designated as an "industrial engineer." Mining has as big a field for such a specialist as manufacturing.

Mining was the first "quantity production" industry and has continued to handle an enormous amount of material in comparison to finished product. Mining, milling, and smelting are successive operations, but they are not always synchronized to give "straight line" operation—the prerequisite of efficient and economical production. The problem is not the purely mechanical one of installing mechanical equipment to move this tonnage from place to place, but the more economic one of handling it at a lower cost per ton. This result is attained by proper selection and application of equipment available and by suitably arranging or co-ordinating it. In the last analysis the problems of mining, as in all industry, are economic; industrial technology is of advantage only in so far as it contributes toward service and economic advantage. In plant layout and design, and in the selection of equipment, the engineer should be guided by but two definite ideas: first, equipment that is safe and efficient, and, second, equipment that is truly economical in operation.

Efficient means that which produces the desired effect. The effect desired in most materials-handling equipment is suitability to service and low cost of operation. To be efficient, the general arrangement of plant and equipment, the equipment itself and its accessories, such as bins, hoppers, feeders, chutes, and transfer points, must be suited to the particular material and service for which it is intended. In fact, 95 per cent of the whole problem is suitability. A suitable general arrangement will avoid excessive handling and points of stricture; it will co-ordinate the system as a whole and synchronize its various units to insure uninterrupted service and continuity of plant operation.

Equipment must be adapted to conditions of space and accessibility, as well as to the character of the material handled, regardless of prejudices for or against various types. Simplicity of design and operation, especially in mining, is an asset. "Gadgets" may improve the look of a Ford, but real engineering made it a dependable machine with few parts. The best equipment will never be satisfactory if its points of feed, transfer, and delivery are not properly designed and adapted to the general conditions and material.

One important point, particularly applicable to mining, and which should always be considered in the general arrangement of plant, is the fact that much less elaborate and expensive equipment is required to transport fine materials than coarse or run of mine. Efficient and uninterrupted operation is more readily secured at feed, transfer, discharge, and storage points if all material is reduced in size as far, and as soon, as possible, after leaving the point of production.

The word "economical" has two meanings—"frugal" and "saving." Frugal implies saving on expenditures, whereas saving suggests the more modern business definition—that is, producing a saving or effecting a reduction in cost. It is conceivable, especially in the present industrial world, that a saving in the cost of producing or handling something might be effected by spending money on equipment that wears out quickly. To be most economical, then, does not necessarily mean that equipment should be low in first cost, nor that it should have long life under operating conditions, but it does mean that it should effect a saving—that is, handle material

at a lower cost per ton than the labor or less efficient equipment it displaced. Frequently economy of space is worth a great deal, as it affects capital expenditures for land and buildings, heating, and similar purposes.

Suitability is an important phase of efficiency. It is best determined by experience, and the wider the experience of the engineer in the general field of materials handling, the better should be the solution of any individual problem. Low cost of operation, the other phase of efficiency, is equally as important as mechanics in designing equipment, because on the cost and on the savings effected depends to a great extent the suitability of the equipment for efficient and economical operation.

As an elementary example consider a belt conveyor. A general impression is that a heavy slow-running belt has a much longer life than a thin one running fast, and that it will, therefore, be more economical, because it will handle more material during its longer life. But a wide heavy belt costs money, and so do troughing and return idlers, head and foot machinery, and the supporting structure for a wide belt. The more numerous the plies in the belt and the larger the head and foot pulleys, the greater the deterioration of the belt in bending on pulleys and idlers. If all items are considered, it will be found that a lower cost per ton is attained by using a narrower belt running at a much higher speed; less belt tension permits the use of a belt of fewer plies and the installation of smaller pulleys, smaller troughing and return idler units, and narrower supports. What little the narrow belt loses in length of life is more than counterbalanced by a much lower capital expenditure for the belt, head and foot machinery, idlers, supporting structure, and building space required. Owing to practically the same charges for power, repairs, and supplies, its low fixed charges will reduce materially its cost per ton handled.

In comparing a proposed installation of mechanical equipment with one already operating, or as against labor-handling, or one type of equipment with another, an estimated cost of operation, or a cost-per-ton comparison, should be made if an intelligent decision is to be reached. The Materials Handling Division of the American Society of Mechanical Engineers has published a paper[1] on the subject that presents five equations for determining the economical advantages or disadvantages of mechanical equipment installations. Personally, and I think to the average engineer, some of the equations seem cumbersome; they need simplification, but at the same time they represent the first attempt to provide the engineer with suitable data for this work.

A simple method of determining the cost per ton for labor-handling methods, or for new or old mechanical equipment, is to divide the yearly cost of operation by the total tons handled. Yearly cost of operations $= A + B + C + D + E$, when $A$ is the allowance to provide for depreciation and obsolescence; $B$, interest on investment; $C$, insurance and taxes; $D$, maintenance; and $E$, power, supplies, and attendance. In industrial accountancy, interest is applied against the full value of the investment for the first year only; also many companies do not consider interest on invested capital as part of production costs. Many companies, however, prescribe that new equipment must earn interest on capital outlay, even when the general accounting system does not so treat invested capital. For the purpose of comparing mechanical equipment with labor, or one type of equipment with another, these differences in accounting procedure are not important, as all permit suitable comparisons to be made. Usually, however, interest is included in a comparison of materials-handling equipment. Consideration of overhead on labor in comparisons of this kind is of questionable value, because, although there is admittedly a large overhead in the employment of labor, it is usually difficult to determine accurately and will be the same, or about the same, regardless of the labor displaced by mechanical equipment. One reason for this is that production is usually so increased that the men released will be absorbed elsewhere in the plant.

Suitability also involves the question of how much capital can wisely be tied up in fixed assets. The aforesaid method of comparing economical operation of various types of equipment emphasizes the fact that fixed charges are continuous. With the exception of power, supplies, and attendance, cost of operation will be the same per year whether the equipment works 2,000 hours or 6,000 hours, whether it carries 500,000 tons or three times that. Cost per ton handled, however, decreases rapidly as use of the equipment approaches continuous operation, and therefore, the nearer such operations are attained the greater the capital investment may be. This has a direct bearing on the problem of suitability, because the capital that may be profitably invested in any equipment depends on the extent to which it will be used. In other words, equipment of small capacity operating twenty hours a day has a big advantage over equipment of large capacity operating only eight or ten hours. Power and attendance in both cases will be about the same, but the small-capacity equipment will not only have a lower operating cost, owing to small fixed charges, but also will require a much smaller investment.

In a consideration of the amount of capital that can wisely be tied up in fixed assets, as a phase of suitability, four items should be considered—namely, cost, amortization, percentage return on investment, and increased production. Cost of the equipment can easily be estimated. Percentage return on the investment is either a specified amount or can be calculated; it can be made so large that, together with depreciation and obsolescence charges, the time required for complete amortization of the equipment can be fixed as desired. Increased production, like cost, can be estimated closely, and these two items can be considered fixed. Return on investment and amortization may then be adjusted to suit conditions. Return on investment will be derived from saving in direct labor costs, savings effected by increased production and from profit; it will be affected materially by hours of operation of the equipment. The number of years required for amortization out of earnings then is equal to the cost of the equipment divided by yearly profit plus yearly allowance for depreciation and obsolescence; or, years for amortization out of earnings is equal to the 100 per cent cost of the equipment divided by the yearly profit plus percentage for depreciation. In other words, any time the amount set aside for depreciation and obsolescence plus profit from the investment equals the purchase price of the equipment, it will be fully amortized, interest being included in calculating the profit. If this method, which is the only logical one, is used in checking the suitability of new equipment, especially materials-handling equipment, or in replacing labor or other equipment, a marked change will probably be effected in conclusions based alone on "good judgment." Many proposed installations will be found to be uneco-

[1]Paper No. 1970: "Formulas for Computing the Economies of Labor-Saving Equipment." By James A. Shepard and George E. Hagemann. May, 1923.

nomical and therefore inefficient, and many operations will be shown to warrant the application of handling equipment where its use is not self-evident.

Much manual labor is still used in regulating and feeding mechanical equipment, and also in reinforcing it at weak points, such as transfer and discharge points, where spillage frequently occurs. This labor could be dispensed with by giving attention to details of design at these points, and by properly selecting the equipment for the installation and by synchronizing the various units.

True efficiency and economy in materials handling can produce big savings, as most of the work done at many plants is in the handling of material.

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# *Soluble Salts as Flotation Reagents*

## Ferrous Sulphate Useful in Chalcopyrite-Pyrite Separations

**Nevin Hal McKay**
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THE PRESENCE of soluble metal salts in milling circuits, derived either from the ore or from the mill water, often introduces one of flotation's irregularities. The importance of these soluble salts might be paralleled to that of the cyanicides in gold-silver milling or of the electronegative impurities in cycles of leaching and electrolyzing. A survey of the quantity and variety of flotation reagents used in the mills throughout the world is an indication to some extent of the quantity and variety of soluble salts which they must combat or with which the flotation reagents must work in harmony.

The most common soluble metal salts are generally the salts of the minerals, including sulphates of zinc, copper, and iron; and salts derived from the gangue, such as sulphates of calcium, aluminum, and magnesium. However, in flotation circuits, many salts often thought of as insoluble enter solution in extreme dilution. The importance of even the weakest solution of such salts will be appreciated by remembering that many of our reagents—notably the promoters—are extremely effective even when present to the thousandth of a pound per ton of ore, which is equal to one part in ten million, or $10^{-7}$ (at 20 per cent solids). At this dilution many of the so-called insoluble salts are in solution in sufficient concentration to influence flotation conditions, so that a list of the soluble salts and also the reagents used to combat them would appear like an abbreviated chemical dictionary. The common polar reagents for destroying the toxic constituents of the ore are lime, soda ash, and sodium sulphite, sulphide, and silicate.

In our files are perhaps forty articles relating to the harmful effect of soluble salts in flotation and the research and mill experiments which have been carried on to obviate their effect, but apparently no notes have been published on the beneficial effect of the soluble constituents of mill heads. Some of the observations made at Matahambre in this respect have led to improved practice in milling. The opportunity of utilizing a soluble constituent is important, particularly in custom milling where ores from different mines can frequently be mixed and milled together with considerable advantage.

One of flotation's best friends is zinc sulphate, one of its most universal reagents, which is at the same time one of the most common of soluble salts. Zinc sulphate is used as a zinc depressant, with or without sodium sulphite or cyanide; it is used to increase the natural differential between the flotability of galena and sphalerite (especially in the presence of soluble copper); and it is used to activate lead flotation (even in the absence of sphalerite). We have treated clean sulphide ores carrying as high as 15 lb. of zinc sulphate per ton, all of which could be used as a flotation reagent by mixing ores.

One opportunity of utilizing the excess soluble zinc sulphate content of some of the custom ores treated in the Salt Lake district is taken advantage of by mixing with ores containing soluble copper. Without intending to be bound by any particular theory, I believe that the favorable results obtained under these conditions are attributable to the fact that when xanthate is added in the lead circuit, with copper in the form of soluble copper sulphate present, the sphalerite also will generally float unless sufficient zinc sulphate is present to determine the formation of zinc xanthate rather than copper xanthate, in which case the lead flotation will be more successful. Many of the Utah lead-zinc ores, particularly from the Bingham, Tintic, and Park City districts, carry copper which is frequently oxidized and soluble. Zinc sulphate, whether added as a reagent or present in the ore, is therefore an important factor in the separation of lead from zinc.

Addition of zinc sulphate with sodium sulphite or cyanide in lead-zinc separations is very common, but in custom milling a large percentage of ores carry sufficient zinc sulphate to satisfy the sulphite or cyanide reaction and even supply an excess. Frequently, however, the ore may carry a serpentine, soapstone, or talcky gangue that seems to protect the sphalerite from surface oxidation or formation of zinc sulphate, so that this reagent must be added. Many of the ores from the Rico district in Colorado fall under this head. On such ores frequently the excess zinc sulphate of another ore may be utilized instead of adding the chemical reagent. One ore, an extreme example perhaps, called for reagents costing 42c. per ton of ore when milled alone, but when milled with another ore contributing necessary salts, the reagent cost was reduced to 16c.

The experience that prompted this article deals with ferrous sulphate, which is generally a bugbear to the

millman. At the Matahambre property of the American Metal Company, where the separation is now chalcopyrite from pyrite, the presence of ferrous sulphate in the ore has proved of value. For ten years the milling was extremely simple because of the almost complete absence of pyrite, and the coarse blocky dissemination of the chalcopyrite in shale, quartzite, and graywacke. Under those conditions the flotation was simple rather than differential, and even table concentration frequently produced a concentrate containing better than 27 per cent copper.

About two years ago, mining operators in the north end of the mine brought in considerable fine-grained sulphides, intimately mixed chalcopyrite and pyrite, which is similar to the cubanite found near San Luis Obispo, Calif. Flotation then became more of a problem, the concentrate dropping in grade from about 28 to 22 per cent copper. Tabling of course was discontinued, as it produced a concentrate of about 15 per cent copper. After several months of this lower-grade production, treatment of the old mine dump of 30,000 tons was begun, and with it the grade of the concentrate improved to 30 per cent. After the dump was consumed, the grade again dropped, the apparent explanation for the condition being that the oxidized dump ore carried ferrous sulphate, which served as a reagent with the cyanide or sulphite to aid in pyrite depression. The dump ore carried not only ferrous sulphate enough for itself but also for the fresh mine ore.

Again, without intending to be bound by any one theory, I believe that in copper-iron separation, ferrous sulphate, generally native in the ore, plays a part analogous or parallel to the action of zinc sulphate in lead-zinc flotation. As to the end reaction of excess ferrous sulphate with xanthate, mill experiment has not yet given data to show whether iron xanthate could be used in copper-iron flotation as zinc xanthate has been used in lead-zinc separations. Apparently sulphated pyrite, which occurs in nearly all copper-iron or lead-zinc-iron flotation, does play a part in the formation of ferrous or ferric sulphites, or cyanides of ferrous or ferric iron, which act in iron depression. The practice here, therefore, has naturally developed of using commercial copperas or iron sulphate with the sodium sulphite or cyanide as a pyrite depressant, with results that have been highly gratifying, yielding again a higher-grade concentrate, higher recovery, and smoother metallurgical performance.

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## Gold Available for Currency and Financial Reserve Exceeds Estimates

ESTIMATES of world gold production and the net amount available for monetary purposes in 1928 and preceding years, published by Joseph Kitchin in the *Harvard Review of Economic Statistics*, are of particular interest as bearing on the question of the probable future adequacy of the supply of gold as the basis for the world's money and credit. These latest figures indicate that total world production has increased noticeably above the estimates made by Mr. Kitchin a few years ago, and that the amount available for monetary purposes has considerably exceeded expectations, especially during the last three years. Mr. Kitchin's figures for the last ten years, converted from sterling into dollar amounts, are as follows:

**(In Millions of Dollars)**

| | Total Production | Consumed in Arts and Orient | Balance Available for Money |
|---|---|---|---|
| 1919 | 365 | 304 | 61 |
| 1920 | 336 | 110 | 226 |
| 1921 | 331 | 66 | 265 |
| 1922 | 319 | 218 | 101 |
| 1923 | 367 | 188 | 179 |
| 1924 | 394 | 334 | 60 |
| 1925 | 394 | 216 | 178 |
| 1926 | 399 | 154 | 245 |
| 1927 | 401 | 148 | 253 |
| 1928 | 409 | 163 | 246 |

During the first few years of this period a steady decline in gold production took place, which, however, was probably continued in 1922 only because of a strike on the Rand in that year. Mr. Kitchin in 1921 estimated that world production would rise from about 325 million dollars in 1921 to about 350 million in 1930. At that time it appeared that the Rand had passed its maximum output, and that any increase in other producing areas would tend to be largely offset by a decline in this largest of producing gold fields. The "New Rand," however, has increased its output considerably beyond expectations, and the "Old Rand" has maintained its output at approximately the level of 1919-1920. In addition, gold production has been resumed in Russia and has been materially increased in Canada. Consequently, world production rose in 1928 to above 400 million dollars. Mr. Kitchin now estimates that the annual production of gold will be about 400 million dollars until 1940, after which he expects a marked decline.

Estimates of the net amount of new gold likely to be available for monetary uses have been even more difficult, chiefly because of the uncertainty as to the purchases of gold by the Orient. Mainly because these purchases have been less than estimated, Mr. Kitchin's estimates of new gold to be added to the world stock of monetary gold have been materially exceeded. In the last ten years the average annual addition to the monetary gold stock has amounted to over one hundred eighty million dollars, or about 1.8 per cent of the total stock, and in the last three years, the annual average has been close to 250 million dollars, or about 2.3 per cent. For the next five years Mr. Kitchin estimates an average annual addition to the monetary gold stock of about 2 per cent.

Although various economists estimate that an annual increase of 3 per cent in the gold stock was required before the war to provide the gold base for the increasing currency and credit requirements of the world's trade, without a decline in the price level, several developments during recent years tend to reduce the need for gold. These include the partial substitution in several countries of deposits in gold-standard countries for actual gold holdings, following the heavy movement of gold to the United States during and after the war; the withdrawal of gold currency from circulation in many countries; and a reduction in legal gold reserve requirements, especially in the United States, accompanying the establishment of the Federal Reserve System—*Monthly Review*, Federal Reserve Agent at New York.

# *Why Hand Drilling Was Abandoned at Almaden Quicksilver Mines*

THE appreciative remarks of the Spanish Minister of Industry when the general estimates of the Spanish budget were being discussed in the National Assembly recently have suggested the following brief review of the development of the state mining and metallurgical works at Almaden during the past five years, states Carlos Mata, technical manager, in *Der Bohrhammer*.

In the period of state management covering the fourteen years 1905-18, the average amount of mercury distilled per annum was 30,688 flasks, which yielded an average net revenue of 5,318,559.42 pesetas. In the six years following the establishment of the Council of Administration in 1918 to the reorganization in 1923, a rapid and constant decrease occurred—even though the yield in the working year 1923-24 temporarily rose to 38,083 flasks—so that only 23,170 flasks were produced in the year 1923-24. (A flask = approximately 56 lb.)

The reader will readily appreciate the difficulties that faced the new management. The vital thing to be done was to mine and produce at the same time, and this meant getting better outputs, as otherwise Spain would cease to derive profits from one of her richest mineral resources. To enable this new program to be realized, new methods of exploitation had to be adopted promptly, which could only be done by adopting modern methods and machine mining. This problem was tackled with commendable keenness by the technical management at the request of the managerial board, which spared neither trouble nor expense to achieve this aim.

Several attempts had been made to utilize compressed air for mining operations, but they had always failed because of the opposition of the work people, and this position was rendered worse at Almaden by the fact that this is purely a mining colony, which was accustomed to live on the mine, and whose inhabitants were sometimes employed at the mine without regard to economic outputs or the necessity for their services.

In 1924—the beginning of the period covered by these notes—the work of exploiting No. 13 level began with mechanical drilling operations. At first, the outputs remained below those obtained from manual work, partly because of the defective system of ventilation, and partly because the arrangements for compressed air supply were far from sufficient. These unsatisfactory outputs were without justification, and the then intolerable position could not persist any longer, although any grounds for dissatisfaction on the part of the workers had to be avoided. Mechanical working was therefore temporarily resumed in June of that year, with a view to its being reorganized to meet any possible objection to its use. A new electric compressor was put into service to replace the old steam compressor. The operations begun on No. 13 level were connected up with the main San Teodoro shaft. In the Castillo adit, connecting the San Miguel shaft with the mine, a suction fan was installed which supplies 1,059,500 cu.ft. of air while stoping operations are going on, and 2,648,740 cu.ft. during changes of shift and after shot-firing operations.

Work was resumed again in 1925 under these new conditions, and since that time everything possible has been done to augment and improve the mechanical drilling equipment. The attention of the managerial board and the technical staff was concentrated mainly on this important point, and though the yields were being increased by bonuses paid to the miners for very good outputs, arrangements were being made to erect and equip an efficient drill forge, to install a new and more powerful compressor, and to put up a shop for repairing and cleaning hammer drills, this shop being equipped on modern lines and suitably staffed. To put it briefly, this modern reorganization resulted in the equipment and arrangements being perfected to a high degree.

The number of hammer drills in service was gradually increased in accordance with this scheme of organization and the funds available, so that on Feb. 1, 1929, all manual labor was dispensed with, except in special cases for remote and unimportant jobs, where it did not pay to carry the compressed-air piping to the working place. Now the yield obtained is produced exclusively with hammer drills.

The result of the reorganization carried out is shown by the following figures of yields of mercury, in flasks: 1924-25, 35,705; 1925-26, 46,701; 1926-27, 53,556; 1927-28, 75,002. These yields have been obtained simultaneously with the opening up of a new level and its connection with the two main shafts, thus enabling the mine not only to maintain the present yield, but to increase it considerably if the needs of the state call for it.

The quantities of cinnabar ore worked, from which this yield of mercury was obtained, amount to about 50,000 tons, and are won on two shifts per day. Present output per shift is 2,794 cu.yd. on mining operations and 1,275 cu.yd. on exploratory or preliminary operations.

*Compressor Plant*—The compressor installed in 1924 is driven direct by a 225-hp. synchronous motor. The compressor put into service in 1927 is belt-driven by a 250-hp. electric motor. Compressed air generated first passes into two interconnected air reservoirs, each holding 353 cu.ft.; and from these it goes through a 6-in. main through the San Teodoro main shaft to Level No. 13, where a distributing reservoir is installed. From this reservoir the air passes into the distributing network after the water and oil deposited in it have been removed.

*Drilling Operations*—These are being carried on exclusively with two types of Flottmann hammer drills, which replace all other types. The NW (AN) 65 hammer drill, weighing about 59½ lb. and mounted on a column, is used for drifting, whereas the Type UWV (DU) hammer drilling machine with pneumatic feed (weight, 101 lb.) is used at the face. Of the former type 33 are at present being used; of the latter, 12 are in use. Work is carried on at fifteen points. Two ham-

mers are allotted to each gang, one hammer for working and the other undergoing cleaning, oiling, or repairs. On each shift all gangs take with them into the pit a hammer that has been overhauled and is in proper working order. Two hammers of each type are provided in the pit as spares for use if unforeseen trouble should occur with the regular hammers, which rarely happens. Mechanics are available in the pit for looking after the air-distributing system and to give assistance if difficulty should be experienced with drilling operations.

*Repair Shop*—A workshop above ground is specially equipped and staffed to keep the hammer drills in working order. Hammers in use the day before are cleaned, lubricated, and, where necessary, repaired in this shop. Air meters are also installed there, to which each hammer is connected up daily, so that each machine is subjected to an accurate test, and full and interesting data are available at any time as to the state and performance of each unit. A careful account as to the working and repair costs of each hammer is kept daily to enable its performance in terms of cost to be verified.

*Drill Forge*—Two sharpening machines are installed in this shop—one American, and one Flottmann sharpening machine recently put into service. Both are in use and fully meet requirements. The mine management is satisfied with results, and the praise accorded by the Minister of Industry is proof that the right method and measures have been adopted.

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# *Calcined Vermiculite as a Plaster Base*

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VERMICULITE is one of the comparatively rare non-metallic minerals the possible economic uses of which have recently been attracting attention. It is classed as one of the micas, being, probably, an alteration product of biotite. According to Dana, jefferisite, or vermiculite, "occurs in broad crystals or crystalline plates. Surface of plates often triangularly marked, by the crossing of lines at angles of 60 and 120 deg. Cleavage: basal, eminent. Flexible, almost brittle. Hardness, 1.5. Specific gravity, 2.3. Luster: pearly on cleavage surface. Color: dark yellowish brown and brownish yellow; and also greenish yellow."

The most important deposits of vermiculite so far discovered in the United States occur in Colorado and Montana, the work described below having been done on material from the latter state. According to Pardee and Larson in U. S. Geological Survey Bulletin 805-B, the deposit in question occurs as a dike-like formation 100 ft. wide by 1,000 ft. long. Its depth is at least 100 ft., but its ultitmate limits are unknown. There are no natural exposures, but its outcrop and the slopes below are mantled with a yielding slippery soil composed chiefly of mica flakes. As before stated, vermiculite is an alteration product of biotite and locally is one of the main constituents of the pyroxenite mass. The percentage of the mixed mass represented by the vermiculite varies from 30 to 84, and an enormous amount of this mixture is present.

The changes that took place in the volcanic stock were caused by hydrothermal metamorphism. In addition to forming vermiculite, the pyroxene (diopside) of the pyroxenite mass was changed into an amphibole asbestos related to tremolite. The presence of considerable amounts of soda and ferric iron suggests, however, that it is probably not as resistant to heat as the true variety of tremolite. Near the surface the asbestos is easily separated or fiberized, owing to its softness. The fibers are weak and inelastic, but they compose a fluffy mass that to all appearances is similar to the general run of amphibole mass fiber. Asbestos that has not been affected by weathering consists of rather harsh fibers that are not so easily separated.

That vermiculite upon calcination expands to a fluffy mass of much larger volume is well known, and this calcined material, mixed with organic binders, has found commercial use. The investigation under discussion, however, was undertaken to determine a satisfactory temperature for calcination and also to investigate the possibility of mixing the calcined material with inorganic binders to secure a light-weight heat- and sound-insulating plaster. The work outlined below was done in the metallurgical laboratory of the University of Kentucky, at Lexington, in that state, by Mr. K. B. Baker under my direction.

In the beginning, it seemed advisable to determine certain of the physical and chemical properties of the vermiculite. It was found that the average expansion on ignition was about 18 times. However, to measure this factor accurately was difficult. If the calcined mineral were crushed to pass a 20-mesh screen, the loosely packed material would occupy about twelve times the volume of an equal weight of raw material, and this ratio could easily be reduced to six simply by shaking. The ratio of the volume calcined to raw material also depended on the size of the latter; that is, if the raw vermiculite was in large lumps the ratio was large, but if it was pulverized before calcination the expansion was much less. As the expulsion of water from the vermiculite is the cause of the expansion, it follows that the more easily the water can escape from the particle the less the thin sheets of the mineral are forced apart and the less the measurable expansion.

The amount of water in the mineral does not seem to be constant, undoubtedly because of variation in the amount of hygroscopic water, which ranges from 6.86 to 7.41 per cent; whereas the combined water varies from 6.77 to 7.05 per cent. A qualitative analysis showed silica, iron, aluminum, magnesium, and traces of sodium and potassium.

The specimens indicated that the vermiculite occurred

in two forms. One of these showed a structure similar to the familiar foliate construction of mica; whereas the other consisted of minute flakes probably produced from the former by weathering. The first type was found to be rather easily breakable into small pieces, though, owing to its flexibility, the breaking should be done in a machine employing percussion, such as a swing-hammer pulverizer. Owing to clogging, the jaw breaker did not work well. The second type showed little cohesive force, being easily broken in the hand, the jaw breaker working quite well on this material. The crude mineral could be comminuted fairly easily in a disk grinder, though rolls or other crushers employing pressure only were found to be of little value, because of the tendency of the material to stick together.

Such powder as was produced was dark green and had a soapy or graphitic feel, indicating some possibility of its use as a lubricant, like graphite. This seems worthy of investigation. When calcined, the first type expanded into an accordion-like structure as each sheet spread apart from its neighbor when the water was expelled. The second type merely disintegrated into small granules.

To find the temperature best suited to calcination, a Hoskins electric resistance furnace was used, together with a Leeds and Northrup hand-operated potentiometer. The vermiculite fed into this furnace varied from pieces 2x2.5 in. down to powder. Swelling commenced at about 400 deg. F., but calcination could not be completed at that temperature. Calcination was complete, however, if the material were put into the furnace at 1,750 deg. F. and left for five minutes. Accordingly, all calcine used in the subsequent investigation was prepared in that manner, for in order to make a good plaster the vermiculite should be dead-burned; otherwise the slick surfaces left in partly calcined powder appear to spoil the bond, so that the resulting plaster is greatly weakened. This calcine was very brittle, and crushed easily, rolls being used to reduce the larger lumps, following by a disk grinder for pulverizing.

The material used in making the plasters was reduced to 20 mesh, though it could easily have been made 100 mesh had such reduction seemed desirable. As mentioned before, the vermiculite in the deposit under discussion is associated with asbestos. Samples of this asbestos were passed through a jaw breaker, where, because of the shortness and brittleness of the fibers, it was easily crushed. The product was then fed to a disk grinder, and a soft, fluffy mass was obtained, later used in conjunction with the vermiculite in the manufacture of plaster. The characteristics desired in this plaster were lightness, fire resistance, and sound and heat insulation. As all of these qualities were possessed by the calcined material, the problem was to find a binder which would not diminish these valuable properties.

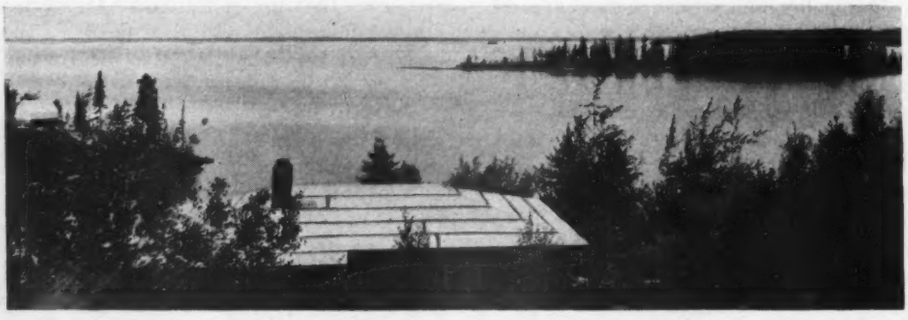
One of the first binders tried was cement. This was mixed with 60-mesh calcined vermiculite in varying proportions with only mediocre results. The plasters formed tended to crumble even when cement was present in amounts as high as one-third of the total. A plastic Kentucky clay was then used, the mixtures running from 15 to 50 per cent clay with the rest 60-mesh calcined vermiculite (the percentages given are for the dry materials, water being added to make a plastic mass). None of these plasters were satisfactory, neither hardening well nor developing any considerable strength. Magnesium oxychloride was next tried, making a fairly satisfactory plaster, except that, when heated, it rapidly disintegrated, with the evolution of chlorine gas. Plaster of paris was the next substance used, and with very good results. Plasters incorporating 20, 30, and 40 per cent plaster of paris, with the rest calcined vermiculite, proved to be highly satisfactory. When the plaster of paris was reduced to 10 per cent, however, the mixture, though very light, was weaker and could probably be used to advantage only with a covering of some sort to protect it and hold it in place.

The next step was to make up mixtures as before with 20, 30, and 40 per cent plaster of paris, but with 10 per cent of the vermiculite replaced by ground asbestos. This seemed to improve the mix, as the asbestos, although the fibers were short, helped to bind the plaster together and so increase its strength. Unslaked lime was also tried as a binder, and plasters were made up containing 20, 30, and 40 per cent lime, with 10 per cent asbestos, the remainder being calcined vermiculite. The last two of these plasters, those using 30 and 40 per cent of lime, were found to be sufficiently strong, but the first could be used only in a protected place. In all of these plasters the time required for the chemical action which caused the hardening was considerable; full setting did not take place short of five or six days.

To test the action of one of the plasters under heat, a mixture of plaster of paris, 30 per cent; calcined vermiculite, 60 per cent; and asbestos, 10 per cent, was prepared and spread on expanding metal nailed to a wooden board. When hard, the sample was placed in a red-hot furnace. The wooden board was thereby entirely consumed, but no disintegration took place in the plaster.

Water glass was also tried as a binder, making a plaster that was rather stiff and hard to work, and one that was considerably heavier than the others, though the density and strength were considerably increased. The resulting plaster was quite different from any of the others, but might be useful under certain circumstances.

The work done indicates that commercial plasters using calcined vermiculite as a base are worthy of further investigation and test on a larger scale than is possible in the laboratory. On account of the extreme lightness of the calcined vermiculite, and its consequent great bulk compared to its weight, the material will have to be calcined at the point of use, however, rather than at the point of production.



*Herb Lake from the Rex Mine*

# MINING AND PROCESSING SILICA AT AN ARKANSAS PROPERTY

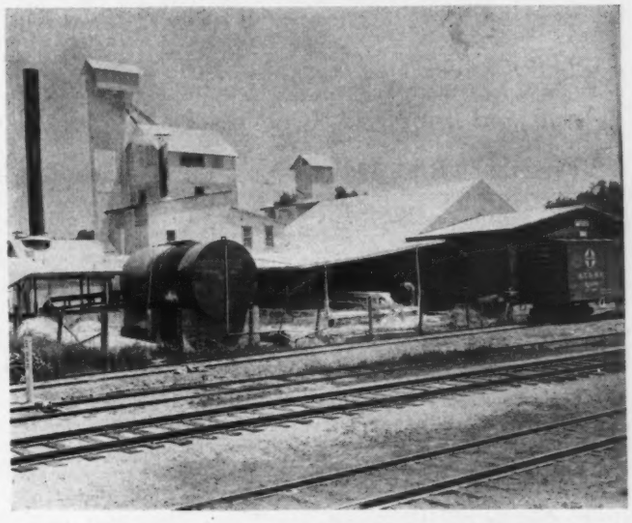
H. R. McKnight
*Vice-president, Corona Silica, Inc.*

THE LARGE deposit of silica owned by Corona Silica, Inc., is four miles east of Rogers, Ark., in the evaculite formation. The company has about 2,500,000 tons blocked out, which has been surveyed and checked by the Southwestern Engineering Corporation, of Los Angeles. A conservative estimated tonnage not completely blocked out is about 10,000,000 tons.

An all-weather road to the deposit has been built by the company. The crude material is moved from the mine to the mill by trucks, each truck hauling 11,000 lb. per load. One truck can easily move 50 tons per ten-hour shift. This form of transportation has proved economical and satisfactory.

The product, to which has been given the trade name Opalite, is an amorphous silica found near the surface. The deposit runs from 10 to 85 ft. in thickness. As it comes from the mine the material is about 99 per cent pure $SiO_2$. It is mined by underground methods. If power shovels were used, the rains would wash the lime and oxides from the clays found above, thereby contaminating the material and increasing the milling and treating cost.

The present mining operation is one shaft with a 250-ton hopper. The drifts are 15 ft. high and 15 ft. wide, having an excellent roof. Pillars, which are zig-zagged, are left to support the roof, and mining conditions are excellent. There is no water in the deposit. The material is friable and snow white. Two drifts are being cut from two sides of the shaft through the hill for ventilation. Hollow-steel air drills are used, and water must be kept at the point of the drill to prevent gelatinizing that otherwise takes place. One small drill will drill 88 ft. of hole in four hours.



*Milling and treatment plant of Corona Silica, Inc.*

Corona Silica's mill is on the main line of the Frisco railroad from Paris, Tex., to St. Louis, Mo., in the city of Rogers, Ark. The plant is electrified throughout, with individual drives for each unit. The material is crushed and conveyed to a pebble mill, where it is wet-ground and treated during the grinding process. Drying is accomplished by a Louisville steam drier. Gayco air separators and Hum-mer screens produce the different mesh products. The product is shipped in 50-, 80-, and 200-lb. bags. Opalite is 99.70 $SiO_2$; the treated product is white under the Benzol test.

## Elutriator for Fine Sizing of Mineral Particles

ACCURATE sizing of mineral particles has always been of primary importance to the ore dresser, points out the U. S. Bureau of Mines. Screens have been in common use for the sizing of coarse particles. Recently screens have come out with 400 openings to the lineal inch (400 mesh), or 160,000 to the square inch. The casual observer might with reason conclude that screening to such a size would be sufficient for almost any purpose. However, in the treatment of many of the low-grade complex ores by flotation the bulk of the ore must often be ground to pass a 200-mesh screen if good recoveries and high-grade concentrates are to be made. Much of the ore is unavoidably ground to such a degree that it is far too fine to be sized by any screen. Since the ore dresser frequently desires to know the characteristics of such fine material, an elutriator has to be used to extend the screen scale.

An elutriator has been used at the Mississippi Valley Experiment Station of Bureau of Mines in co-operation with the Missouri School of Mines and Metallurgy, Rolla, Mo., which will successfully size material finer than 400 mesh. In principle the elutriator is similar to that designed by Messrs. Gross and Zimmerly at the Salt Lake Experiment Station of the Bureau. However, a change had to be made in controlling the flow of water. Valves were not satisfactory for very small streams. Cutters were devised to take all of a large stream part of the time. By means of these cutters the flow of water is regulated to give increments that bear the same grain-size relationship to each other as exists between coarse particles sized on standard screens. The elutriator will now run for a long period without attention, whereas formerly the flow of hydraulic water was irregular.

# British Columbia's Copper Mines Prospering

F. H. MASON
*Special Victoria Correspondent*

**With Copper Prices Stabilized at 18c., Production Is Expected to Show a Substantial Increase Over Former Records . . . Britannia Exploring for Orebodies Below 2,700 Level . . . Granby Puts Bonanza Into Production and Increases Reserves at Copper Mountain . . . Premier Gold Developing New Properties.**

WITH only a few unimportant exceptions, the producing mines tributary to the British Columbia coast are copper, gold, and silver mines or gold mines. With the enhanced price of copper the copper mines have prospered, and all are making record productions. The copper production of this province for 1929 will exceed all previous records by between 5,000,000 and 6,000,000 lb., and the tonnage treated, owing to the possibility of treating profitably lower grades of ore, will far exceed previous records.

Howe Sound's Britannia mine is now the largest single copper producer, though Granby Consolidated Mining, Smelting & Power Company's production from its three mines — Hidden Creek, Bonanza, and Copper Mountain —exceeds it by about 50 per cent. The Britannia mine was discovered in 1898, and experienced sundry vicissitudes until it was taken over by the Britannia Mining & Smelting Company, a subsidiary of the Howe Sound company, ten years later. Though the mine has suffered from snowslide, flood, and fire, all of which devastated much property, it has prospered amazingly. Britannia was the first company in British Columbia to adopt flotation, in 1912, and since has used the process as the chief method of separating the valuable minerals from the gangue.

The mine, as it stands today, is the result of the gradual consolidation of five mines, known respectively as the Jane, Bluff, Fairview, Empress, and Victoria mines. It has been developed by a series of adits, some of which have been driven through the mountain. The work represents about 50 miles of drifting and crosscutting. At present the bottom working adit is on the 2,700 level, and is more than 11,000 ft. long. The main haulage tunnel is on the 4,100 level, but the face of this tunnel is a long distance from the nearest known ore deposit. A winze is now being sunk from the 2,700 level to explore the Bluff deposit at still greater depth. If this work should warrant such a step, the 4,100 level may be driven to this deposit, if not beyond. Bluff deposit ore consists of a series of veins of varying size, occurring in a shear zone of great, but irregular, width.

With the exception of the two years 1920 and 1921, when the mill was under construction, to replace the one burned, the mine has been a steady producer. Up to the end of 1928 it had to its credit, in round figures, 328,200,000 lb. of copper, 1,681,900 oz. of silver, and 75,138 oz. of gold, from 11,000,000 tons of ore. During the first eleven months of this year it has produced about 38,400,000 lb. of copper, 13,000 oz. of gold, and 180,000 oz. of silver. In the same period, the mill has been stepped up to a capacity of 6,000 tons daily and at times has exceeded 7,000 tons. It has been found economical to eliminate some of the fine crushing by classification, and the removal of barren or exceedingly low-grade material before the ball mills. An elaborate series of precipitating troughs has been erected for recovery of copper from the mine water, in which scrap tinplate has been found a far more effective precipitant than scrap iron. During the current year, nearly 1,000,000 lb. of copper will be recovered in this way, if the operators' expectations are met. Last year the company produced 70,000 tons of iron pyrite, running 49 per cent of sulphur, as a by-product of its milling operation. About the same quantity will be produced during the current year.

The Britannia company has recently acquired control of the Toric and options on the control of the Dolly Varden and Wolf mines, and the Alice Arm-Dolly Varden Railway, which connects the group of mines with tidewater, at Alice Arm. A large vein of silver ore, 60 to 120 ft. wide, has been exposed by drifts and crosscuts in the bottom level of the Toric mine. Last year the mine produced 19,968 oz. of silver and 21,911 lb. of lead from 1,540 tons in an inefficient mill. No production has been made this year, but Britannia has done and is doing a large amount of development. Though no information as to the result had been made public, the fact that the option has been exercised indicates that the result was favorable. Development on Dolly Varden and Wolf has been suspended until next spring.

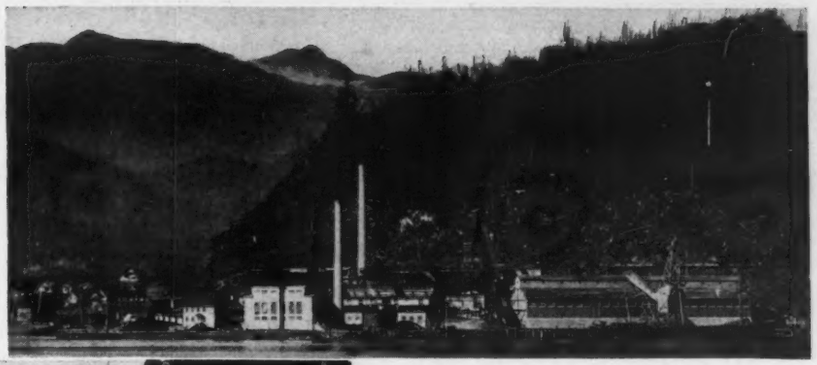
Britannia's concentrate is smelted at Tacoma.

Granby Consolidated Mining, Smelting & Power Company's Hidden Creek mine, near Anyox, has been in steady operation since 1913, and the 13,980,000 tons extracted to the end of 1928 has yielded approximately 440,530,000 lb. of copper, 4,760,000 oz. or silver, and 88,200 oz. of gold. Published statements by the company, however, indicate that production from the company's three properties for the full current year will be about 61,000,000 lb. of copper. About 39,500,000 lb. of this will be produced at Anyox from the Hidden Creek and Bonanza mines. During 1929, a good deal more ore is reported to have been taken out of the Hidden Creek mine than has been developed. The

*Dormitories at Britannia, Howe Sound's copper subsidiary*

company has an option on the Hanna group of sixteen claims, adjoining Hidden Creek; has had a geophysical survey made of the property; and has done considerable diamond drilling. Results of this work have not been made public.

The Bonanza group was brought into production last February, and about 400 tons of ore is being conveyed over the tramway to Anyox daily. The orebodies on this property have not yet been delimited. Before the property was opened at least 500,000 tons was indicated by diamond drilling. The nature of the deposit, dipping into the mountain, prevented further exploration by diamond drilling from the surface.



*Above—Granby's Anyox smelter. At the left, concentrator of Premier Gold in Portland Canal district.*

Ores produced at Hidden Creek and Bonanza mines are concentrated at Anyox. The concentrate is sintered, mixed with siliceous ore and other fluxes, and smelted in a blast furnace. and the resulting matte is reduced to blister in converters. The blister is refined at Tadanac by Consolidated Mining & Smelting. Until the beginning of last September, Anyox blister was refined in New Jersey, but the present arrangement allows the producer and refiner to divide the federal government bounty of ½c. per pound on copper rods and bars.

During the year, Granby has increased its activity at Copper Mountain, where the orebodies are proving larger and richer at depth than exploration by drilling had indicated. An old building has been converted into a bunk house to house 80 extra men who have been under canvas during the summer, and in the spring a large new boarding house will be erected. Present signs point to the company again making its chief center of activity in the Boundary district, where its operations originated. The Allenby mill has been stepped up to a capacity of 2,500 tons daily. The concentrate is smelted at Tacoma. Production for the year will be about 21,500,000 lb. of copper. Besides 61,000,000 lb. of copper, Granby will produce about 425,000 oz. of silver and 11,000 oz. of gold during the current year, from approximately 2,500,000 tons of ore.

Premier Gold Mining, in the Portland Canal district, near the Alaskan boundary, reports that during the first ten months of this year it mined 255,790 tons, containing about 2,076,000 oz. of silver and 87,000 oz. of gold. Production has been normal and there have been no unusual occurrences. No mention is made, it will be noticed, of the large lens of new ore that is reported to have been found between No. 5 and 6 levels. This famous mine, which, with the Sullivan mine, has done so much to attract the attention of the world to the mining possibilities of British Columbia, up to the end of 1928 produced 1,346,600 tons of ore, containing 913,950 oz. of gold, 22,168,200 oz. of silver, 7,000,000 lb. of lead, and 125,000 lb. of copper.

Premier Gold has done extensive exploration and development on other properties. It recently completed a 5½-mile cable tramway, connecting the Prosperity and Porter-Idaho properties with tidewater at the mouth of the Marmot River, on the Portland Canal, and it has made a first shipment—about 600 tons—from these properties. It also is developing the Silverado group by a tunnel that has cut the shear zone at a depth of 600 ft. The property is on the opposite side of Bear River from Stewart.

Hedley Gold Mining, near Hedley, in the Yale district, at one time was one of the principal gold producers in British Columbia. In the last decade, however, it has failed to make operations pay. During the ten years prior to 1919 it paid $4,089,000 in dividends. In the ten years since 1919 it has produced gold, silver, and arsenic to the value of $2,715,847 and has paid out in wages and supplies, $2,794,967. To reduce the cost of operation the mine has been closed during the winter in recent years. It has just closed. The production for the year was about 13,000 oz. of gold.

Pioneer Gold Mines operates a mine in the Bridge River district. It recently has extended its vertical shaft to the 1,000 level. Near the bottom a new 3-ft. vein, which was cut again in driving a crosscut to the main vein, has been found. Assays of the new vein ran about $40 in gold and silver. The company has remodeled its mill and increased its capacity to 125 tons daily. Production for the current year has not been ascertained. Production last year was 7,730 oz. of gold and 1,400 oz. of silver from 14,360 tons.

Planet Mines put its new 100-ton mill, at Stump Lake, in the Nicola mining division, into operation early in the summer of 1929, and gradually tuned it up to capacity, at which it has been running for about two months. The concentrate is shipped to the Selby smelter, and brings a net return of between $200 and $250 per ton. Production has been small, and no large reserve of ore has been developed, though the possibilities of the property appear to be good.

*The Allenby or Copper Mountain concentrator of Granby near Princeton*

# COMMENT AND CRITICISM

## *First-Hand Information From Russia*

*To the Editor of "E.&M.J.":*

Just having returned from Russia, I was very interested in reading Leslie Urquhart's letter published Nov. 16; also your excellent editorial of the same date. Then, on Nov. 30, I was surprised to read the amazing communication from Lynwood Garrison, of Philadelphia.

Aside from the stated issue—that is, Mr. Urquhart's claims against the Soviet government—it seems that Mr. Garrison's statements regarding the *status quo* in Russia require some answer.

Mr. Garrison declares that the masses of Russians are simple peasants "now ruled by a small minority of half-educated and untrained city dwellers who call themselves the Russian Soviet, and are probably the most corrupt, cruel band of cutthroats to be found in history." I do not know what he means by "untrained city dwellers." Does he infer that people in this category are not trained to cosmopolitan life? That the present governing body in Russia is composed of half-educated men is too sweeping a generalization to even consider. As to the corruption charge, I can say definitely that as far as I ascertained from personal interviews with Concessions Committee and other officials, and general observation extending from Leningrad to the Caucasus, this is particularly non-existent, and perhaps its absence is one of the strongest features of the Soviet form of government. In this respect other countries have much to learn from the Soviets. While the Russians undoubtedly possess a certain cruelty, of which I, as many other Americans, do not approve, to stigmatize the "untrained city dwellers" as "cutthroats" is hardly warranted. In Soviet Russia there is undoubtedly a great amount of injustice and cruelty accompanying punitive measures now being carried out, but even the bitterest opponent of communism must admit that this is a deliberate outgrowth of policy and idealism which justify the Russians, in their own eyes, at least, for sealing communism with an iron hand. It is questionable, however, whether prevalent cruelties even compare to those practised under the Czar. The extreme measures now taken arise from necessity, and are not mere indulgent outbursts.

In regard, particularly, to the claims of the Russo-Asiatic company, it occurs to me that Mr. Urquhart's position is not essentially different from that of other foreigners whose properties were nationalized. He might apply for a concession or concessions which would enable him to operate his old properties under a new status, such as did, for example, the present Lena Goldfields Company, which before the revolution operated as the Lena Gold Mining Company, or the present Tetiuhe Mining Corporation, which acquired the property formerly belonging to the Selection Trust, Ltd. The present form of concession agreement is designed primarily to safeguard the Soviet from foreign exploitation, and while the government encourages the entrance of foreign capital, it takes every precaution that development work by foreigners is held safely within certain bounds. In other words, it seeks to prevent a condition which has arisen in other outlying countries where foreign capital has exerted so great an influence in the actual workings of governments. While this new policy does not meet with the approval of many foreigners, it is perfectly justified from Russia's point of view, inasmuch as the Soviet government has a perfect right to legislate in its own country as it sees fit. Mere disagreement with Soviet ideas does not necessarily imply that these are erroneous.

The present Russian government is interested in obtaining the services of American engineers, not only to develop its resources but to train its own engineers in using modern methods. To accuse the Soviet government of incompetency, inefficiency, and ignorance is cyring out in the face of actual achievement. Mr. Garrison has only to refer to any reputable source—I would suggest, among others, the U. S. Department of Commerce, Russian Division—and he will be unpleasantly surprised to discover the accomplishments of the Soviet government since 1923. He will learn that not only has the present régime largely wiped out an appalling illiteracy, but many industries are now operating at greater than pre-war capacity, particularly coal mining. Railroad mileage has been increased and operation made more efficient. Water-power developments have been undertaken on a scale which dwarfs anything under the Czar, and the general industrialization program of the "Five-Year Plan" will go far toward transforming Russia from a purely agricultural to an industrial country. This indicates that the Soviet government has not only sufficient money for development of its resources but also organization and technical ability.

Nationalization of lands is no concern of the American mining engineer going to Russia, and the quarrel between the Soviet government and Mr. Urquhart can be settled only by a court of arbitration. Employment is offered by the Soviet government in good faith and can be accepted by any reputable mining engineer whose interests are in mining.

ARNOLD HOFFMAN.

*New York, N. Y.*

Can the American mining engineer accept a position in Soviet Russia without forfeiting his self-respect? Mr. Leslie Urquhart and Mr. Lynwood Garrison have stated the case for the negative in our issues of Nov. 16 and 30. Mr. Arnold Hoffman, who has just returned from Russia, takes issue with them, thus agreeing with the editorial stand of *E.&M.J.* as expressed in the two issues mentioned.

## *Bibliographies and Technical Research*

*To the Editor of "E.&M.J.":*

May I be permitted to take up your valuable space with some further remarks on a subject, which I believe to be of great importance. I was pleased to note, in your comment on p. 705 of the issue of Nov. 2, that *Engineering and Mining Journal* is in agreement with the suggestion that a comprehen-

sive index to the world's scientific literature would be of inestimable value. If that suggestion were considered by all those interested in the progress of science and invention, I dare say that the same opinion would be arrived at generally. I am convinced that the suggestion is worthy of examination and, after some consideration, I have arrived at the conclusion that if we could agree that a comprehensive index to the world's scientific and technical literature is desirable, we could have it tomorrow.

Hidden in books, to which vast additions are constantly being made, enormous masses of valuable information lie stored. New information is published, only to be buried out of reach in hundreds of thousands of volumes on the library shelves. For want of this information, time and money are wasted in repeating experiments that have already been made, often more than once. That is the position.

To make these records available as the basis of further progress is a comparatively simple matter. This has not been done, hitherto, because few have realized that bibliography in this sense is a special study. As physical experiment cannot be performed without both theoretical and practical knowledge, so the organization of a satisfactory bibliography requires both study and experience. Fortunately, this is a point which scientific men will be the first to realize, and, indeed, the results of an intensive study of the problem are so simple that they can hardly be gainsaid.

The amount of material to be indexed is so vast that a bibliography can be produced only by collaboration of many workers. But the present output of bibliographical references, by those engaged in the preparation of abstracts and indexes, is so great that it is comparable with the number of scientific and technical papers published. Therefore, we have merely to unify this output, by the adoption of a standard classification by means of which it would be possible to bring together into one great index all the references published. All bibliographers using the standard system would thus be contributing to a great index to recorded information. There is a classification which is suitable for indexing the whole of knowledge in the greatest detail. This is the international extension of the Dewey Decimal Classification, which is now being used increasingly all over the world. If we could agree to adopt it universally, the thing would be done.

From one point in your comment the professional bibliographer would be inclined to dissent. That those directing research have usually to search the literature of their subject themselves or at least to superintend the search, is true, but really this should be the function of the special librarian. He should collect the literature, so that none is missed, and provide a complete index to it. When information is wanted on a special subject, he should be able to produce all the records immediately, thus saving the time of the director of research.

This is what the Science Library is endeavoring to accomplish. By adopting the International Decimal Classification it has, in a few years, compiled a bibliography of one and a quarter million references. All published references classified in this system are mounted on cards and added to the index, and this will grow in extent exactly at the same rate as such references are published.

S. C. BRADFORD.

*London, England.*

[In a recent contribution to *The Engineer*, Doctor Bradford has explained that, in the Dewey Decimal Classification, each subject is denoted by a number. Titles of papers, or other recorded information, are numbered according to the subject to which they relate and pasted on cards of uniform size. When the cards are arranged in numerical order, which is done by unskilled labor, all the cards relating to information on a given subject fall together, no matter by what agency the titles were numbered. A copious alphabetical index of subjects is made, so that, to find what information has been indexed on a given subject, all that is necessary is to look for the number in the A, B, C, and then find the drawer which contains the cards bearing that number. This is a matter of a few moments, instead of the several weeks which would be necessary to consult all the parts of the miscellaneous bibliographies that might contain references to the subject of inquiry.—EDITOR].

# Impoverishment Prior to Cyaniding

*To the Editor of "E.&M.J.":*

Your editorial of July 20, last, and Messrs. Charles Butters' and E. M. Hamilton's letter of Aug. 31 and Oct. 26, respectively, relative to the "impoverishment of an ore before treatment," could well be collectively classed as a treatise on hydrometallurgical flow sheets.

Mr. Hamilton's concise comments on Mr. Butters' letter were nearer a defense of his (Mr. Hamilton's) scheme of treatment than practical consideration of the San Albino flow sheet. Specifically, I refer to Mr. Hamilton's statement that two cyanide plants would be in operation, one each for the flotation concentrate and the flotation tailing. In my experience, flotation of a precious-metal ore, carefully carried out, has resulted in a high concentration ratio, say 100:1; this of course in the absence of appreciable quantities of base metal. At this ratio and Mr. Butters' tonnage, the flotation product could be cyanided in four 55-gal. drums.

Mr. Butters states that the flotation tailing can be treated with a consumption of ¼ lb. of cyanide per ton and a contact of only twelve hours. This is the probable result of removing the sulphides by flotation, along with the other deleterious base metals. As I understand it, the flotation concentrate, after roasting and washing, consumes another ¼ lb. of cyanide, which I surmise is calculated on the entire tonnage, thus totaling a consumption of ½ lb. of cyanide per ton by the combination process against a consumption of 3 to 4 lb. of cyanide in the operation of the straight cyanidation.

Granted that the extraction would be the same, Mr. Butters' saving of $1.10 on chemicals could easily be dissipated by the cost of power, repairs, fuel, labor.

TABLE I

| Heads $8 Ag; $2 Au<br>Silver, 50c. per oz.<br>Gold, $20 per oz.<br>Extraction, % | Method No. 1<br>Flotation and cyanidation | | Method No. 2<br>Gravity and cyanidation | | Method No. 3<br>Flotation in solution and cyanidation | |
|---|---|---|---|---|---|---|
| | Conc. 55 Ag—82 Au<br>Bull. 38 Ag—11 Au | | Conc. 12 Ag— 3 Au<br>Bull. 76 Ag—89 Au | | Conc. 55 Ag—12 Au<br>Bull. 33 Ag—80 Au | |
| Total | 88 Ag 93 Au | | 88 Ag 92 Au | | 88 Ag 92 Au | |
| Concentration ratio | 80:1 | | 60:1 | | 100:1 | |
| Chemicals per ton | $0.65 | | $0.55 | | $0.76 | |
| Governmental tax on contained Ag and Au | Conc., 5.25%<br>Bull 2.25% | | Conc., 2.25%<br>Bull., 2.25% | | Conc., 5.25%<br>Bull., 2.25% | |
| Smelter settlement on concentrate. | | | | | | |
| 95% of Ag content | 95% of 55 | | 95% of 12 | | 95% of 55 | |
| 98% of Au content | 98% of 82 | | 98% of 3 | | 98% of 12 | |
| Cash value of product | | | | | | |
| (A) before haulage.. Conc. | $3.95 Ag—$1.52 Au | | Conc. $0.87 Ag—$0.06 Au | | Conc. $3.95 Ag—$0.22 Au | |
| Bull. | 2.56 Ag— 0.21 Au | | Bull. 5.94 Ag— 1.74 Au | | Bull. 2.56 Ag— 1.56 Au | |
| | $6.51 | $1.73 | $6.81 | $1.80 | $6.51 | $1.78 |
| | | 6.51 | | 6.81 | | 6.51 |
| Smelter and refining charges—total | | $8.24 | | $8.61 | | $8.29 |
| Deduct for power (B) | $0.12 | | $0.01 | | $0.07 | |
| Deduct for freight | .13 | | .18 | | .11 | |
| Deduct for chemicals | .65 | | .55 | | .76 | |
| | $0.90 | 0.90 | $0.74 | 0.74 | $0.94 | 0.94 |
| Recovery (C) | | $7.34 | | $7.87 | | $7.35 |

(A) After deducting governmental tax and smelter settlement discounts.

(B) Power, labor, and maintenance for grinding and cyanide plants a constant for each process, maintenance for flotation and gravity concentration equipment calculated as equal. Deductions are for items pertaining to each individual process.

(C) Recovery before milling, smelter, and refining charges.

TABLE II

| Heads $8 Ag, $2 Au<br>Silver, 50c. per oz<br>Gold, $20 per oz.<br>Extraction, % | Original flow sheet | | Flotation in solution and cyanidation | |
|---|---|---|---|---|
| | Conc. 6 Ag—11 Au<br>Bull. 76 Ag—81 Au | | Conc. 58 Ag—54 Au<br>Bull. 31 Ag—38 Au | |
| Total | 82 Ag | 92 Au | 89 Ag | 92 Au |
| Concentration ratio | 90:1 | | 50:1 | |
| Chemicals per ton | $0.88 | | $1.00 | |
| Cash value of product (A) | Conc. $0.45 Ag—$0.21 Au<br>Bull. 5.95 Ag— 1.57 Au | | Conc. $4.16 Ag—$1.00 Au<br>Bull. 2.42 Ag— .75 Au | |
| | $6.40 | $1.78 | $6.58 | $1.75 |
| | | 6.40 | | 6.58 |
| | Lead | .10 | Lead | .28 |
| Total | | $8.28 | | $8.61 |
| Deduct for power (B) | $0.003 | | $0.073 | |
| Deduct for freight | .12 | | .20 | |
| Deduct for chemicals | .88 | | 1.00 | |
| | $1.003 | 1.003 | $1.273 (C) | 1.273 |
| Recovery (D) | | $7.277 | | $7.337 |

(A) After deducting governmental tax and smelter settlement discounts as in Table I.
(B) Deductions as in Table I.
(C) Fuel and labor for drying concentrate and additional sacks not included.
(D) As in Table I.

and losses through theft, pertaining to the flotation unit.

I have recently had the opportunity to observe a set of experiments to accomplish a preliminary impoverishment of a silver-gold ore where the minerals were argentiferous galena, sphalerite, chalcopyrite, pyrite, psilomelane, and pyrolusite. Of the manganese minerals the psilomelane predominated, and a large part was removed on tables, the concentrate assaying 17 per cent Mn. The ore had been milled in a standard all-slime cyanide plant with tables following the primary grinding unit, giving an unclassified feed of minus-10 mesh and 26 per cent —200 mesh. Cyanide consumption, including mechanical loss, was 7¼ lb. per ton. Decomposed sulphides and wall rock resulted in high acidity and a colloidal pulp. Head assays were $8 silver and $2 gold. Extraction was 82 per cent Ag and 92 per cent Au, 6 per cent of the silver and 11 per cent of the gold being recovered on the tables.

Laboratory tests were conducted by flotation, flotation followed by cyanidation, gravity concentration followed by cyanidation, and flotation and cyanidation in which the pulp was floated in the standard cyanide plant solution. I will pass up the interesting metallurgical problems encountered and consider the results from an economic point of view. Straight flotation gave but 55 per cent extraction, and will not be included in the data. Table I shows the results as determined in the laboratory. Calculations are on a metric-ton basis.

Balancing the results of the different methods as enumerated, No. 1 was discarded as a complicated flow sheet and calling for expensive alterations to the mill. No. 2 showed the most favorable cash value of product, but the concentration ratio was lower than that in No. 3. That this ratio and/or extraction could be maintained with the operators available seemed doubtful.

Method No. 3 gave promise of an easily operated plant and a possible reduction of time of cyanide contact, thus providing extra agitators to handle a proposed increase in mill tonnage. New development in the mine showed a small tonnage of ore assaying 5 per cent lead occurring as a sulphide. This would be more amenable to flotation than gravity concentration because of the fine grinding necessary before liberation of the precious metal.

After consideration of the tests and the assumptions just mentioned, a mill-scale plant was installed and operated intermittently for some days, with results similar to those shown by the laboratory work, and a concentrate was produced that assayed $350 in silver, $66 in gold, and 25 per cent lead. A sudden enthusiasm for flotation was inspired and equipment was ordered and installed to handle the entire mill tonnage. Results of the operation are given in Table II, and in direct comparison with results obtained by the original flow sheet. Lead content of ore in each operation was about 0.6 per cent.

Conditions encountered during the initial operation were disconcerting. A continued use of the tables proved to be necessary, thereby lowering the concentration ratio to 50:1. Cyanide consumption did not decrease as expected, but was reduced to 5½ lb. per ton. I will mention here that the previous consumption of 7¼ lb. was due to a needlessly high concentration of cyanide in a foul solution. This was thought necessary for the maximum extraction at that time. The depressing effect of the cyanide inhibited the flotation of the base metals, other than lead, with the attendant fouling of solution as experienced in the original operation.

Upon starting the plant an attempt was made to decrease the time of solution contact, but this was found to be impracticable. Fuel and additional labor for drying flotation concentrate also became a cost item. Compensating factors were the greater extraction of silver and lead, though the final recovery was increased only 6c. per ton.

Normal cyanide consumption for the original operation should have been about 6 lb., and Table II would then show a difference of 8c. in favor of the original flow sheet.

A peculiar item to be noted is that, due to taxes on the flotation product, the higher the price of silver, the lower the cash value of the flotation-cyanide product as compared to that of the gravity-cyanide originally produced. However, at this writing, attempts are in force to obtain a reduction of tax on flotation concentrate, which, if granted, will alter the figures in Table II.

In reviewing the laboratory work and the known results of the two mill operations it appears that the No. 2, or gravity-cyanide flow sheet, shows advantages over the other two, both from an economic and a purely metallurgical point of view. Microscopic examination of the ore showed the base metal, excepting the pyrolusite, to be amenable to gravity concentration performed as the mineral was freed and before excessive comminution. The lead in the original concentrate paid for all costs of production and marketing, the precious-metal content remaining as value recovered. Lower cyanidation costs would be effected by the preliminary removal of the deleterious metals, and further benefits accrue by the recovery of that precious metal susceptible to gravity concentration and not solvent nor floatable in cyanide.

To expect a careful operation to surpass the results obtained by the original plan of gravity separation is reasonable, in which event, monetary returns for the gravity-cyanidation combination treatment on the ore in question should closely parallel those that are given in Table I.

In an attempt to answer the Editor's question, "What constitutes impoverishment," I would say: "The utilization of an economical auxiliary process to remove that portion, and no more, of the mineral not amenable and/or deleterious to the primary or essential method of beneficiation indicated by experimentation." E. G. Howe.

*El Paso, Tex.*

Nov. 26, 1929.

# By the Way

## Where Honor Is Due

THE PATIENT, toiling pack animals that lost their lives in the great Klondike gold rush some thirty years ago have finally been rewarded with a memorial. Overlooking the grimly named "Deadhorse Gulch," at Inspiration Point, on the White Pass railroad, Alaska, there was dedicated recently a bronze tablet, honoring the 3,000 animals that served in the Klondike stampede. The tablet portrays a pack horse and mule on the trail. It was paid for by contributions from old "sourdoughs."

The estimated average life of a horse or mule used in gold-rush packing was five weeks. The cold weather, one of the greatest hazards to all concerned, was a new experience for the animals, just as it was for the majority of miners. Great demands were made upon the animals, and little care or food could be given in return. Often the trails were marked by the skeletons of the unfortunate beasts of burden.—New York *Times.*

# Digest of Current Literature

**Cyaniding Brazilian Gold Ores.** Fred W. Freise. *Metall und Erz.* November, first number, 1929. Black gold occurs in many places in Brazil, though the instances are often overlooked because of the superficial resemblance to other dark minerals such as titaniferous and magnetic iron ores, rutile, and wolframite. The dark incrustation on black gold consists of humic acid salts of iron. Cyaniding, with the usual cyanide concentrations, is ineffective because the humic compounds decompose cyanide with formation of potassium carbonate. The cyanide solution must therefore be strong enough (4, 5, or even up to 8 per cent) to provide a sufficient excess for cyaniding after the decomposition by humic compounds is completed. Experiments have also been made in cyaniding other Brazilian gold ores, notably those containing tellurium, antimony, silver, or palladium associated with the gold. The results are tabulated, showing the composition and particle size of the ore, and the amounts dissolved in 12, 24, 36, and 48 hours. The usual cyanide concentrations have little effect in dissolving the compounds of gold with tellurium and antimony; and the dissolving power decreases as the ores become richer in these metals. Tellurium differs in this respect from selenium, which has a great affinity for cyanide. In compounds of gold with silver, the dissolving power is in proportion to the silver content. Treatment of gold-palladium ores is complicated by the fact that part of the palladium also goes into solution; and separation is then very difficult to accomplish without serious losses of gold. Artificially prepared alloys dissolve somewhat more readily than the naturally occurring alloys.

**Wire-Wound Furnace.** C. Sykes. *Metal Industry* (London). Nov. 1, 1929. A small furnace has been developed for metallurgical investigations requiring temperatures from 1,100 to 1,650 deg. C. It is wound with molybdenum wire, utilizing porous or non-porous tubes as inner lining. It permits accurate temperature control, is not liable to hot-spot, and can be arranged to exclude carbonaceous matter and oxidizing gases. The winding is protected from corrosion by an atmosphere of inert gas. If it is desired to work without this limitation on the furnace atmosphere, a non-porous (Pythagoras tube) inner lining may be used. In this case the winding is protected from corrosion in another way—namely, by an alundum tube between the wire and the lagging. This type of furnace has been operated at 1,650 deg. C. for short runs, but its limiting temperature for continuous use is probably not above 1,550 deg. C. The current density may safely be as high as 50 amp. per square millimeter at 1,650 deg. C., and much more than this at lower temperatures. The lagging thickness must be adjusted as a compromise between electrical efficiency and speed of operation; with thin lagging the power input for a given temperature is large; but if the lagging is very thick the cooling time becomes very long. With kieselguhr lagging, if the casing diameter is about four times the internal diameter of the furnace tube, 3.5 watts per square centimeter of winding area will heat the furnace to 1,650 deg. C. in a reasonably short time. This furnace compares well with the nichrome furnace in reliability, and has long life with proper care.

**Russian Industry:** Aluminum. *L'Industrie Chimique,* November, 1929. Experiments have been made in the production of aluminum from Russian raw materials at the Viborg Works of the non-ferrous metals syndicate. The ore used for these trials was bauxite from the Tikhvine district. Even the electrodes used in the process were of Russian origin, having been made at the Koudino Works of the electrical syndicate. The electrolytic operations at Viborg were carried out by apprentices and workmen under the supervision of Russian scientific men. At present, work is under way to put a factory in Leningrad into production of aluminum metal on a commercial scale. The intention of the Soviet is to have ready a trained corps of technical men and factory operatives adequate for proper functioning of the large aluminum foundry which is to be built on the Dnieper River. This foundry is being planned to have an annual productive capacity of 10,000 tons of aluminum.

**Ore Dressing.** G. Quittkat. *Metall und Erz.* October, second number, 1929. As the best ore deposits are being worked out, and the necessity arises for utilizing lower-grade ores which are more difficult of preparation, applied microscopy is becoming more and more important in ore-dressing practice. At high magnifications it is possible to detect precious-metal inclusions in sulphides and arsenides; and by estimating the amount and nature of these inclusions, choice of the best treatment is greatly facilitated. Results are reported of developments in the microscopy of ores in the Krupp-Grusonwerk Laboratory, at Magdeburg. These include the detection and examination of copper in pyritic and zinc ores, of zinc in pyritic ores, and of platinum, gold, and silver in various sulphidic ores. Photomicrographs are shown of the distribution of galena in siliceous gangue; copper pyrites in quartz; galena in a pyritic ore; a sulphidic platinum inclusion (sperrylite in pyroxene); a complex of iron and copper pyrites, covellite and quartz; chalcopyrite in zinc blende, and zinc blende in pyrites. The correlation of these and like microscopic observations with choice of the most effective and economical treatment of the ore for maximum yield of metals opens a highly useful and remunerative field for this branch of technical microscopy.

**Thermal Properties of Ores.** W. A. Roth. *Zeitschrift für angewandte Chemie.* Oct. 12, 1929. Although metallurgical operations are carried on to an enormous extent as compared with other chemical reactions in industry, available data on the thermochemistry of such reactions are meager. For this reason calorimetric measurements have been made of reactions involved in the reduction of oxidic ores of manganese, nickel, and iron. These measurements covered heats of oxidation and reduction of compounds of these metals (oxides, carbonates, carbides, and volatile carbonyls). Heats of combustion were also calculated (not directly measured) for certain silicides and phosphides. The measurements were carefully made, and the reaction products quantitatively analyzed to make sure what reactions were actually represented by the observed heat effects. Most of the results obtained for heats previously measured by others differed from the published data. In some cases there was radical disagreement. In general, the newly measured heats were found to be higher than the published data. Experimental results are tabulated, the probable limits of error being stated. Some of the older published figures are included for comparison. The table gives heats of formation of the compounds mentioned, both at constant volume and at constant pressure.

**Briquetting Presses.** Pennewitz. *Braunkohle.* Oct. 19, 1929. There has been some discussion as to whether the output of a briquetting press could best be increased by increasing the speed of the stamper or by modifying the mold design. In an investigation of this question, the unexpected observation was made that the expansion of a briquet on leaving the mold, which may amount to several millimeters, depends only on the size of the final outlet passage of the mold, and not on the width of the constriction leading to the outlet. On this basis, output and briquet quality are best aided by designing the mold so that the final outlet passage is just long enough and wide enough so that expansion of the briquet as it leaves the mold does not occur, or at least becomes negligible. Tables of data and diagrams are shown to support these statements. The redesigned mold, with lengthened outlet, gave the following advantages: At the same press speed, the quality of the briquet was less dependent on the moisture content of the material; its strength was increased about 10 per cent; and a higher output, or working of a more difficult material, could be effected without increasing the speed of the press. The investigators believe that more attention should be given, in briquetting practice, to mold design as a means of increasing output and improving briquet quality.

**Rare-Earth Metals.** Robert Müller. *Monatshefte für Chemie.* Rudolf Wegscheider Festschrift, October, 1929. Some of the rare-earth metals, having the same valence as aluminum but being more like magnesium in basicity, follow closely the peculiar electromotive behavior of aluminum. Lanthanum and cerium are examples. Lanthanum resembles aluminum in that its amalgams indicate for it a higher place in the electromotive series than has the pure metal. This is probably because oxide film passivation causes the pure metal to behave more like the noble metals. Electrolytic preparation of pure lanthanum metal was successfully accomplished by Auer von Welsbach. The temperature-potential curve of cerium is similar in shape to that of lanthanum; and its other electromotive behavior is also quite similar. Other rare-earth metals also will probably be found to show like properties. Lanthanum metal and cerium metal are produced by the Treibach Chemische Werke.

# USEFUL OPERATING IDEAS

## Wider Pulleys and Belts Lessen Renewal Expense

*Increasing Use of Line-start Motors Prompts Attention to Problem of Slippage and Damage*

J. R. HOPKINS
*Chicago Belting Company*

STANDARD motors operate with a compensator, which regulates the current. With these motors it is easy to control the load on the belt while starting. Line-start motors, on the other hand, take the current direct, so that their design is the only factor affecting its inrush.

About 15 per cent of all motors in use today are line-start motors. Five years from now, 70 per cent will probably be line-start motors. The chief designing engineer of a large electric-motor manufacturing company sees no reason why line-start motors should not supplant all standard motors over 5 hp. and up to 30 hp.

The leading motor manufacturers are making line-start motors of two types, normal-load motors and high-torque motors. Both are capable of a high starting overload, though the high-torque motor has a possible starting load higher than that of the normal-load motor. In spite of this higher starting load, most motors of both types are being equipped with the same pulley widths as for standard motors. One reason for this is that pulley sizes are specified by the National Electrical Manufacturers' Association, which has not yet taken up the matter of deciding which are the most desirable pulley widths for line-start motors.

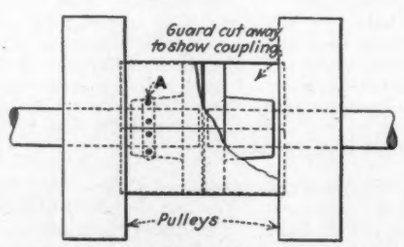
The effect of the starting load on the belt must be considered. The Westinghouse company has made one model that has a 50-per cent wider pulley. Some companies and engineers maintain, however, that the higher starting load is but momentary, and not of sufficient duration to affect the belt adversely; but tests have shown that when a line-start motor is put in motion, the pulley spins around against the belt. The length of time it may spin thus depends on the load, which is heavier in some instances than in others.

Normal-load line-start motors have less starting torque than have high-torque motors, but even normal-load motors of this type need wider pulleys and wider belts. A standard motor has an overload in starting of 112 per cent at the shaft. A normal-load line-start motor has an overload in starting of 150 per cent at the shaft.

Normal-load line-start motors require a pulley and belt from 20 to 25 per cent wider than is necessary with a standard motor. High-torque line-start motors should be ordered with pulleys 50 per cent wider than those used on standard motors of the same rating on all motors of 10 hp. or over. On these motors the maximum torque in starting ranges between 2.38 times full load and three times full load.

## Guarding Lineshaft Couplings

SOMETIMES a pulley must be mounted next to a coupling on a lineshaft, states C. H. Hays, in *American Machinist*, and in rare cases pulleys must be mounted on each side of the coupling, as shown in the illustration. If the distance between the edge of the pulley rim and the adjacent side of the coupling flange is less than the width of the belt, the belt coming off of the pulley on the coupling side will be in danger of being caught and wound up between the coupling and the pulley. The result would probably be that either the belt would be torn in two, or the lineshaft hanger, or the hangers of a countershaft, would be torn from their fastenings. In any case, a serious accident, and even loss of life, might occur.

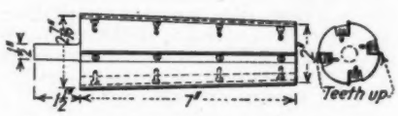


*Guard for lineshaft couplings*

To avoid the danger from such an accident, the coupling should be guarded and the guard should extend well beyond the pulley rim. Such a guard can be made from two pieces of sheet metal rolled into half circles of the same radius as that of the coupling flange, and attached to the flange by countersunk-head screws. The guard can be strengthened by metal straps, such as the one shown at *A*, attached to the inside near the ends. A guard of this kind can easily be removed to give access to the coupling bolts, and it eliminates the danger of accident if the belt should come off of the pulley.

## A Novel Use for Discarded Hacksaw Blades

THE illustration herewith shows a taper reamer of peculiar design, writes R. H. Dauterich, in *American Machinist*. The body is made of mild machine steel and has four longitudinal grooves, into which hacksaw blades are



*This reamer has cutters made from hacksaw blades*

fastened by means of beveled clamps. A pattern-maker uses it for reaming taper holes in hard wood.

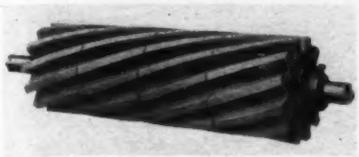
Operated at about 200 r.p.m. in an ordinary drill press, the reamer makes a smooth taper hole. Two of the saw blades are set with their teeth outward and projecting about $\frac{1}{8}$ in. from the body. The other two blades are set with their backs outward. Suitable clearance for the chips is made in the body, in front of each blade.

## Economizing on Valves

AT ONE well-known mine, writes an observer who favors a combination of efficiency and frugality, the waste of 2-in. gate valves is enormous. One day in one level we examined eight of them, discarded because a hand wheel was broken, or the stem broken or so bent that it was hard to open. No doubt several more had been discarded and picked up. One man made it a practice to take home discarded valves that could be removed easily. He said each was

# New Cleaner Prolongs Life of Conveyor Belts and Reduces Labor Costs

CLEANING the dirt off the return side of a conveyor belt is important in the efficient and economical use of such equipment. This is particularly true when wet and sticky material of an abrasive nature is handled. If not removed, such material causes serious wear of return idlers, besides forming



*New rubber "squeegee" for cleaning the return side of conveyor belts*

accumulations on the floor beneath the belt, the removal of which involves appreciable labor expense.

Many different devices have been used to clean the return side of belts, but none has been entirely satisfactory. Stationary scrapers damage the belt, require constant adjustment, and are only partly effective on sticky material. Bamboo and other brushes wear out quickly; compressed air is expensive; and heating devices are not wholly successful.

A rubber "squeegee" cleaner, shown in the accompanying illustration, has recently been devised by the Robins Conveying Belt Company. It consists of a series of spiral flutes made of high grade rubber. The roll is made up in sections, 6 in. long and 7½ in. outside diameter, which are mounted on a wooden core. The wearing portion of the cleaner is ¾ in. deep. A peripheral speed of 1,000 ft. per minute is employed.

The cleaner should be placed far enough back of the head pulley so that the belt is straightened from its crowning over the head pulley; this arrangement makes the cleaner effective over the entire width of the belt. The spiral shape of the flutes on the cleaner prevents the belt from flopping up and down, and, as the cleaner bears lightly against the belt, it preserves not only its own life but also that of the belt.

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worth 40 or 50c. to him when he sold it to the junk man.

It would pay a mining company to send a man around occasionally to gather up the discarded valves and either fix them up on the level or take them on top to have new stems put in. Also to have on hand a few parts, such as hand wheels and stems for replacements, when it is impracticable to remove the valve.

One man with two 24-in. pipe wrenches, a hack saw, and a file could earn big dividends. If a valve has only the hand wheel broken off, he could file new shoulders on the stem, fit a new hand wheel, and rivet the stem over it. As an experiment I made such a repair in exactly 18 min., a new hand wheel being available. If a hand wheel is not available, it is a simple job to cut off the portion of the stem projecting from the wheel, punch out the square portion, and then replace the wheel. Such a job will take half an hour.

If the stem is bent so badly that it is too hard to turn, it must be replaced. To do this, cut off the wheel, remove the bonnet, and screw the stem out from the inside of the latter. A new stem can be screwed in, a new wheel put on and riveted, or the old wheel may be replaced.

One boss made the objection that a new valve cost only about $3, and that it was cheaper to put on a new valve than to fix an old one. On the contrary, the labor of taking down a lot of piping to remove a valve will often cost several times the price of a new one.

In one instance we were ordered to change a valve that had a bent stem. This valve led to a header with twelve branches, and not a 2-in. union near. To tear down and rebuild the header would have taken us at least four hours, with a labor cost of $7.40, to say nothing of the cost of the new valve and of several cast-iron fittings that we would probably have broken to save the labor of unscrewing them. Inasmuch as the place was extremely hot, and water containing copper in solution was dripping everywhere, we hunted up pieces of other valves and made the repair in about one hour and at a labor cost of only $1.85.

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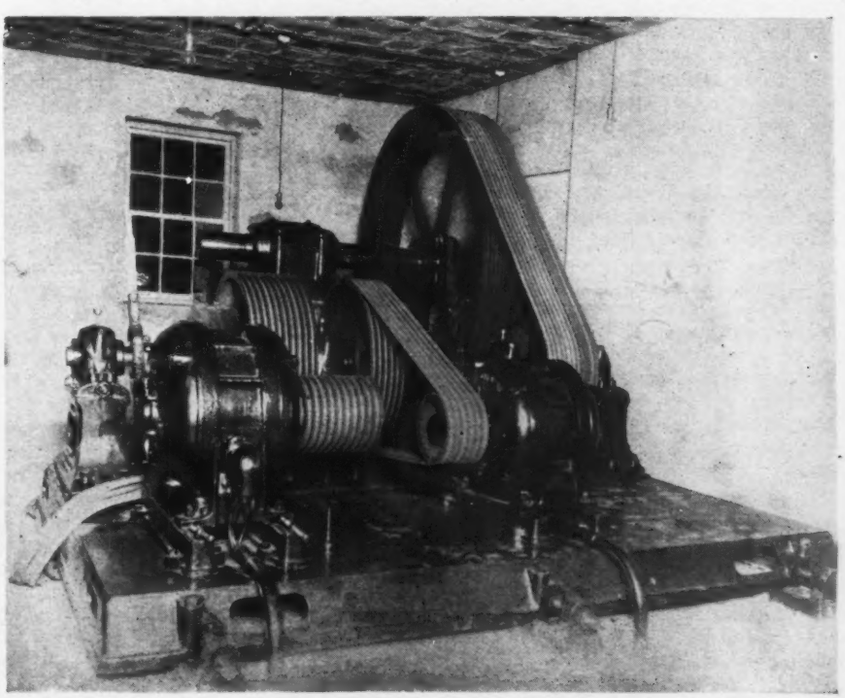
## Fan Motors and Clutches Mounted on Unit Base

TO GUARD against a long interruption of ventilation in case of a motor failure and to provide a means of increasing the fan speed as the mine is developed, a unique arrangement was selected for the fan drive at a property in West Virginia, according to *Coal Age*. The driving-unit parts, consisting of two motors and a countershaft with two multiple-disk clutches, are mounted upon a large cast-iron base, which in turn is mounted on slide rails to provide belt center adjustment for the fan pulley belt.

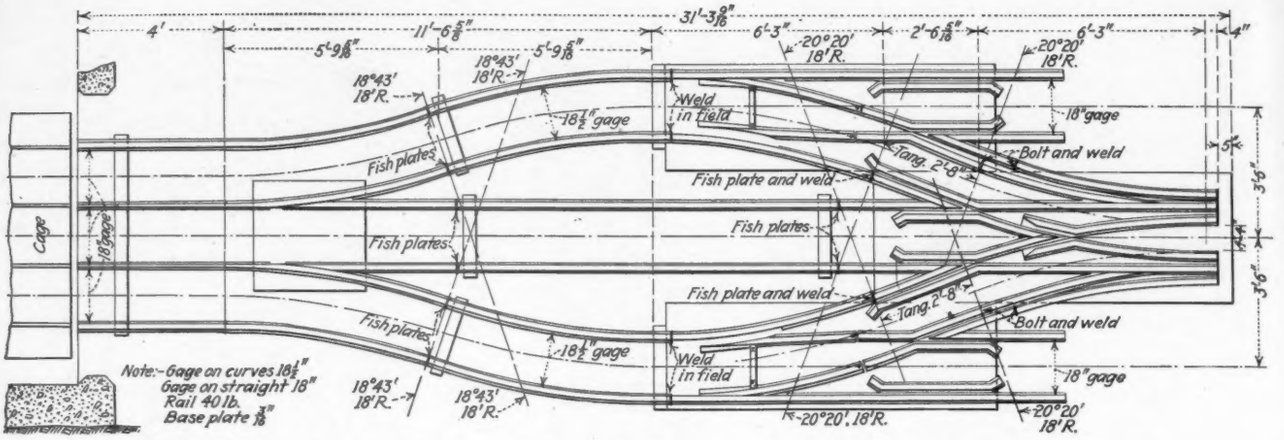
Squirrel-cage rather than slip-ring induction motors are used, because of their simplicity, greater reliability, and lower cost. The same advantages apply to the motor starters. Because this type of motor is not applicable to variable speed duty it was necessary to provide pulley ratio changes to accommodate the increases of fan speed, as more air is required.

One motor is rated 40 hp. 575 r.p.m. and the other 75 hp. 865 r.p.m. The pulley ratio of the first gives a fan speed of 51 r.p.m. and that of the second a speed of 102 r.p.m. By substitution of a larger motor pulley, the 40-hp. motor can be made to drive the fan at 76 r.p.m. and likewise the 75-hp. motor can be made to drive it at 127 r.p.m. By the one substitution of the two motor pul-

*Adequate provision has been made for tightening each belt in this fan drive*



# New Track Layout Speeds Up Shaft Operations at United Verde Mine




*General plan of track layout in No. 6 shaft stations of the United Verde Copper Company, Jerome, Ariz.*

UNDERGROUND stations of No. 6 shaft of the United Verde Copper Company's mine at Jerome, Ariz., have recently been equipped with a three-track layout, replacing boiler plate turnsheets. For unloaded or lightly loaded cars, the turnsheet was satisfactory, as the car could be skidded into position by one man. A car loaded with two tons of drill steel, however, required two or three men to handle it on a turnsheet. To avoid delays in loading and unloading the large quantities of underground supplies that are transported through the shaft, the track layout shown in the accompanying sketch was developed. With this layout, loaded cars are run from the cage on to the two outside tracks, and empties are run from the center track on to the cage. Cars may be switched from and to the cage over any of the three tracks, which also provide larger storage facilities.

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leys the arrangement will therefore provide four fan speeds—namely, 51, 76, 102, and 127 r.p.m. Intermediate speeds would require the purchase of pulleys of intermediate sizes.

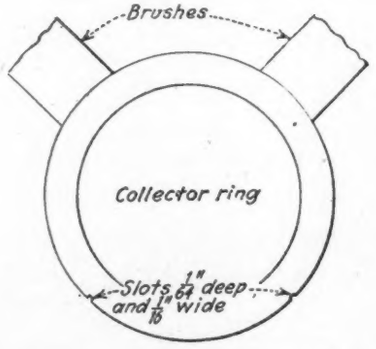
The cast-iron base, which is 8 ft. 9 in. by 12 ft. 2 in., is mounted on three slide rails. Thus the whole driving unit is made movable for adjusting the tightness of the main belt, which rides on the 96-in. fan pulley. The base with its clutch-fitted countershaft was designed and made especially for the job by the Allis-Chalmers company, the maker of the V-belt drives with which the unit it fitted.

When the accompanying illustration was made the 40-hp. motor was doing the driving and the endless belts of the 75-hp. motor were lying on the base in readiness for application. Perhaps when the mine has been further developed the belts of both motors will be kept in operating position so that a shift of drive from one motor to the other can be made by operation of the two clutches. Keeping one set of belts off, obviates the necessity for regular lubrication of the respective loose pulley on the countershaft.

## Reducing Wear on Slip Rings and Brushes

THE slip rings of alternating-current generators and motors often wear unduly because of abrasive grit, states W. E. Warner in *Power*. This is caused partly by the wear on the rings and the brushes and partly by the action of the atmosphere. As this grit has no means of escape except across the face of the ring, it tends to work into the brushes. This trouble can largely be prevented by cutting four shallow narrow grooves around the face of the slip ring as shown in the drawing. These grooves can be made with a hack saw. They should be about $\frac{1}{64}$ in. deep, the edges being smoothed down to give a good surface. The dirt worn from the rings and brushes will collect in these grooves instead of under the brush face.

The adoption of this method has in many installations reduced the wear on the brushes and rings and improved the operation of the unit.

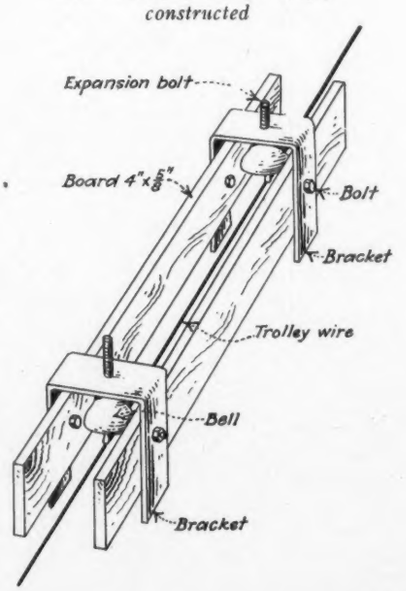



*Grooves in face of slip ring collect abrasive grit and prevent it working into the brushes*

## Simple Trolley Guard

The trolley guard pictured herewith is of the usual board type, states G.D.B. in *Coal Age*, but it is hung from brackets made from bar iron ¼ in. thick and 1½ in wide. The brackets are shaped into a square U, through the middle of which is drilled a hole for the expansion bolt that holds it in place. The dimensions of the boards need be no more than 4 in. wide and ⅝ in. thick.

*This trolley guard is simply constructed*



# Personal Notes

**I. J. A. Diamond** returned recently to Johannesburg from Southern Rhodesia.

**R. L. Strobel,** of New York City, left on Dec. 4, for a professional trip to Colorado.

**E. G. Howe** has returned from Etzatlan, Mexico, and is now at El Paso, Tex.

**Walter C. Mendenhall,** chief geologist of the U. S. Geological Survey, was in New York City this week.

**Alvah J. Haley** has left Butte, Mont., for Bolivia, where he has been engaged as geologist by Patiño Mines & Enterprises.

Dr. **Marshall Haney** recently spent several days in Giles County, Va., making an examination of a manganese property.

**Richard A. Parker** returned recently from Japan on the "President Pierce," after attending the World Engineering Congress in Tokyo.

**J. F. McCarthy,** president and general manager of Hecla Mining, attended the Mining Congress meeting in Washington, D. C., last week.

**C. Maxwell Norman,** of the staff of Rhodesia Congo Border Concessions, is at Morenci, Ariz. He plans to return to Africa in the near future.

**J. J. Jordan** will be in charge of development work being started by Treadwell-Yukon, on the Wilson lead-zinc claims, near Alpha, Nev.

**Samuel G. Lasky,** geologist for the New Mexico Bureau of Mines, is in Washington, D. C., where he expects to remain for several months.

**Charles Janin,** of San Francisco, has returned from Bodaibo, Siberia, where he had his headquarters during a trip to the Lena Goldfield properties.

**Blamey Stevens,** manager of Lane-Rincon Mines, Inc., near Taluca, Mexico, arrived in New York from England on Dec. 3, on his return to the property.

**T. C. Hoelzer,** of the Metal & Ore Corporation, sailed for Europe on the "Leviathan," on Dec. 7. Mr. Hoelzer expects to return from this business trip in about six weeks.

**D. B. Gemmill,** president of Prince Consolidated Mining, operating at Pioche, Nev., has returned to the United States after a stay of two years in Mexico. Mr. Gemmill is now in Salt Lake City.

**H. A. Hansen,** for several years mill foreman at the Tom Boy mill, at Telluride, Colo., has been appointed mill superintendent for Mexico-Colorado Mining, near Silverton, Colo. A. Rische has been made master mechanic.

**R. D. Leisk,** of Jerome, Ariz., who has been visiting copper properties in Northern Rhodesia and Namaqualand, sailed from Cape Town on Nov. 22. He will be in New York City about Dec. 18. Mr. Leisk expects to return to Jerome after Jan. 1.

**E. H. Dawson,** manager for Whitworth Mining & Finance, operating the Fairbanks Creek and Fish Creek dredges in the Fairbanks district of Alaska, has closed operations of his company for the season, and has returned to London.

**Frederick Burbridge,** of Wallace, Idaho, manager of Federal Mining & Smelting, with property on Canyon Creek, in the Coeur d'Alene district of Idaho, was elected president of Hidden Treasure Mining at a recent meeting in Spokane.

**J. H. Crowdy** and **Ralph T. Hirsh,** respectively manager and engineer of the New York Alaska Gold Dredging Company, operating near Nyac, in the Kuskokwim district of Alaska, have stopped operations of their company for the season, and are en route for New York City.

**F. C. Mulford,** assistant mill superintendent for Patiño Mines & Enterprises, operating in the Uncia district of Bolivia, sailed from New York for South America, on Nov. 27, on the "Essequibo." Mr. Mulford has been in the United States since last August, visiting Western milling plants.

**Robert C. Canby,** consulting metallurgist, of New York, who had attended the World Engineering Congress in Tokyo, and was continuing on a tour around the world, was taken ill suddenly at Peking, China. He was travelling with **G. T. Cottle.**

**Frank L. Hess** returned on Nov. 26, from a nine months' stay abroad. He spent four months in China, doing professional work near Canton, in the province of Kwang Tung; and in the province of Kwang Si. Mr. Hess was in the Malay Peninsula, Ceylon, India, and Italy for the rest of the time.

**J. O. A. Carper,** mining engineer, gave an address on the past, present, and future of mining in Colorado, at a recent meeting of the junior Chamber of Commerce of Denver. **C. Lorimer Colburn** and **George E. Collins** also attended the meeting, and each added a few words of advice to the young business men.

Dr. **Otto Sussman** was elected president of the American Metal Company, Ltd., at a meeting of the board of directors in New York City on Dec. 5. Doctor Sussman, who fills the vacancy created by the resignation of **C. M. Loeb,** has been with the company for 25 years, and has been a vice-president for twelve years.

## OBITUARY

**Leslie Ellis,** mining engineer with Hercules Mining, at Wallace, Idaho, was killed in a mine accident on Nov. 26, at the Dayrock mine, about three miles north of Wallace. Mr. Ellis was 28 years old.

**A. C. Gilmore** died at his home in Prescott, Ariz., on Dec. 4. He was well known to mining men of Yavapai County and for several years had been in charge of its mining exhibit at the state fair. Mr. Gilmore was 72 years of age.

**Robert Mulford** died in Ogdensburg, N. Y., on Dec. 8. He had retired twelve years ago after an extensive career as a mining engineer in Central America and Mexico. Mr. Mulford, who was 66 years of age, graduated from Columbia University in the class of 1884. He is survived by his widow, a son and a daughter.

**James A. White,** mining engineer in the exploration department of F. W. Bradley, of San Francisco, was killed in an automobile accident near East Gate, Nev., on the Lincoln Highway, on Nov. 29. Mr. White was born in Knoxville, Tenn., in 1860, and his family moved to California in 1862. He received a common school education, and went to the gold fields, where he was employed as a millman by several companies. Since 1887 Mr. White had been affiliated with the Bradley interests.

## James Douglas Medal Presented to Paul Merica

AT A MEETING of the New York section of A.I.M.E. on Dec. 4, S. Skowronski presented the James Douglas medal to Paul D. Merica, and gave a short résumé of Dr. Merica's many achievements in the field of alloys, especially those of aluminum and nickel. Dr. Merica, in his response, took the opportunity to thank his associates at the Bureau of Standards and International Nickel, stating that he considered the medal a reward for collective work rather than his own individual achievements. C. E. MacQuigg, manager of the research department of Union Carbon & Carbide, gave an interesting review of the development of the alloy steels, a development that has largely taken place in the present century, and which is progressing with great rapidity. Among the facts brought out was the importance of the alloy steels for tools in the automobile industry, where, it is estimated, a yearly saving of $200,000,000 is accomplished, not taking into account the extra cost of machinery required if an inferior grade of tool steel were used. In bridge construction, where the use of alloy steel has made possible the construction of spans of steadily increasing dimensions, not only added strength but improved elastic qualities have been gained. Attention was called, in the discussion which followed, to the growing importance of alloy steel in railroad construction. Alloy-steel rails have been put to the most severe tests, with gratifying results. The first nickel-steel boiler, constructed about four years ago, was such a success that since that time over 150 locomotives have been equipped with similar boilers.

# NEWS OF THE WEEK

## American Mining Congress Re-elects Tally President for Another Year

*Collective Curtailment of Metal Production Discussed as Only Means of Stabilizing Industry—Taxation Session Draws Crowd*

By A. H. Hubbell

OUTSTANDING features of the annual meeting of the American Mining Congress, held at the Mayflower Hotel in Washington on Dec. 4-7, were, first, the re-election of Robert E. Tally, vice-president of United Verde, to head the organization for another year. Second, a lively discussion of the methods, in vogue and proposed, of making depletion allowances in mine taxation. Third, some pointed talk on the failure of the mining industry to get anywhere in devising legal ways of curing overproduction. Fourth, a review of the public lands situation in the Western states, the members being urged to work with the President's commission. Also worthy of note was an address dealing with the government's efforts to avert depression, by a member of the President's Committee on Seasonal Operation in the Construction Industries.

### The Convention Starts

At the luncheon to delegates with which the convention was officially opened, Mr. Tally, as president, welcomed those present and said that the speakers on the program had been selected so as best to present the mining industry's problems in quest of their proper solution. A. G. Mackenzie, of Salt Lake City, as toastmaster, introduced, among others, James F. McCarthy, president of Hecla Mining, who was attending the annual general meeting for the first time; R. C. Allen, executive vice-president of Oglebay, Norton; J. H. Hand, of Yellville, Ark.; and Dr. E. H. Wells, president of the New Mexico School of Mines, who spoke briefly and optimistically on mining conditions in his state. Zinc now had second place to copper there in the list of metals, owing to the American Metal operations near Pecos, Dr. Wells said. The American Potash Corporation had recently started a shaft near Carlsbad, N. M., to explore the potash occurrences that had previously been disclosed by drilling.

M. D. Harbaugh, recently chosen secretary of the Tri-State Zinc and Lead Ore Producers' Association, succeeding Julian D. Conover, now secretary of the American Zinc Institute, was also introduced. He painted a rather gloomy picture of conditions in his district. Most of the mines were shut down. The tumble taken by the zinc market in October had left their industry in the lurch for the rest of the year and possibly for some time in 1930. He

R. E. Tally

was looking for suggestions. He felt that when the story of zinc had been told effectively, as had been that of copper, their industry would take a turn for the better.

James F. Callbreath, needing no introduction as secretary of the Mining Congress, was called upon for a word. Quoting a slogan adapted by J. D. Zook, president of the Illinois Coal Operators' Labor Association when the latter's industry was in difficulties, he said "Hats off to the past, but coats off to the future." This applied excellently in present instances, he said, where operators were finding the going rough. Ideas and energy would solve any problem.

### A Cure Wanted for Overproduction

"Trends in Industry" was the general topic of the opening session at which James F. McCarthy presided. Mr. Tally spoke on "Advancement in Stabilization of Industry." Individual producers vexed with taxation problems would find their problems much more difficult on coming to Washington, were it not for the Mining Congress, he said. The organization, if it would, could make itself of equal value in stabilizing the industry.

The aim of industry in stabilization was the adjustment of supply to demand, with well-directed efforts to increase demand. But stabilization would succeed, the speaker said, only on a basis of fairness to all the interests concerned. The producer was entitled to a fair return on his investment and the risk involved; the consumer to receive his products at reasonable prices and under competitive conditions; the employee to receive good wages. Moreover, government must be sympathetic. The producer must know that the need is real, that the means proposed is within the law, and that he will not be harassed by investigation. President Hoover was engaged in a program for the stabilization of business and was receiving the active co-operation of federal, state, county, and municipal administrations and of the nation's industrial and financial leaders, he said. This experiment deserved continued and whole-hearted national support. The Mining Congress welcomed the opportunity to co-operate with all industry in developing plans not only for the stabilization of mining, but for business in general.

Curtailment was the only answer to overproduction, but it should not be used to put a premium on high-cost production, cautioned Mr. Tally. Low-grade deposits must be left for the improved metallurgical processes of the future.

Although some curtailment had taken place in mining, he continued, definite signs of overproduction were visible at present which would require a more drastic readjustment, or prevailing prices could not be maintained. Coal, iron, zinc, and copper mines had been developed beyond consumptive requirements, naturally leading to excessive production. Overproduction disrupted the economic structure of an industry, and if extended to industry in general, the business of the country suffered to the extent of a depression.

The copper industry had not fared well since the war, he said, as the average price for the last five years had been less than that for the twenty-year period before the war, notwithstanding higher costs of production. "But the copper industry has the courage to take advantage of periods of depression to prosecute its research, development, and construction campaigns. Large amounts of copper will be needed for the future industrial expansion of the country, and the domestic copper resources are not large. The same condition exists in

connection with zinc resources. Both industries have been overdeveloped, and although there has been some individual curtailment it has not been altogether effective."

Moreover, individual producers hesitated to curtail production, Mr. Tally said. Collective curtailment was the

BRUCE YATES

only remedy for overproduction. If the industry followed the maximum production theory, low prices, wages, and inadequate earnings would result.

### ACTION WANTED—FEWER WORDS

Considerable discussion revolved about the topic treated by Mr. Tally. R. C. Allen precipitated it by saying that if archaic laws were the reason for lack of stabilization (or curtailment), why not attack the laws directly? Steps that had been attempted, however, all seemed to have been taken more or less furtively. There was no way to govern production save by collective curtailment. But he had yet to read or hear a constructive suggestion as to how the status might be revised so that we might do what was obviously needed to remedy the condition. Some practical suggestion was necessary as to altering the rules of the game so that these things might be done without danger of criticism, conviction, and punishment. He suggested that the Mining Congress appoint a committee to bring about some such action.

Another speaker, A. Scott Thompson, said that we talked much about stabilization. If this meant collective curtailment, any lawyer would say it could not be done, if price fixing were considered. The Supreme Court had spoken in the plainest English. But there must be some way of getting away from the letter of the Sherman Act. No one (he said) would ask the repeal of that act, but there must be some way in which the zinc industry, for instance, could get together and work out a solution of the problem under the law.

The points raised were sound, said Mr. Tally, entering the discussion. Past abuses were preventing producers from getting together now. This country had been developed under a hands-off policy pursued by the government, and he thought the opportunities thus afforded had been abused. Prominent producers were now unwilling to assume responsibility for doing something illegal. Possibly a way could be worked out whereby abuses could be curbed. It would be difficult in that many agencies must be considered. But it meant so much to the mining industry that the latter should grapple with it. However, he claimed, the Mining Congress could do nothing unless it were asked to undertake the task. Appointment of the committee, as suggested, might be a good thing and the members ought not to give up the idea. For the industry to continue to deplete its reserves without adequate return was unsound. Here was a splendid field for constructive work.

## Officers Elected

Robert E. Tally, vice-president and general manager of United Verde Copper Company, was re-elected president of the Mining Congress. Other officers were chosen as follows:

Vice-presidents, S. Livingston Mather, Cleveland-Cliffs Iron Company, Cleveland; J. F. McDonald, president of the Downtown Mines Company, Leadville, Colo.; Col. T. B. Davis, of the Island Creek Coal Company, New York.

Secretary, J. F. Callbreath, of Washington, D. C.

Executive Committee: Messrs. Tally, Davis, and Clinton H. Crane, of the St. Joseph Lead Company, of New York.

Directors for three years: Messrs. Crane and Davis; W. J. Jenkins, Consolidated Coal Company, St. Louis; Stanly A. Easton, Kellogg, Idaho; and Louis S. Cates, of the Utah Copper Company, Salt Lake City. Director for two years: C. J. Ramsberg, Koppers Company, Pittsburgh. Director for one year: A. E. Bendelari, Eagle-Picher Lead Company, Chicago.

### GOLD PRODUCERS BETTER OFF

Following Mr. Tally's paper, Bruce Yates, manager of Homestake Mining, talked on conditions in the gold industry. Most producers in the United States had made the readjustments in their affairs necessary to net a small profit. Nevertheless, gold brought them only $20 per ounce. Any improvement must come from further lowering of costs without cutting wages. Production of gold in 1928 was $46,165,400, a reduction of 54 per cent since 1915, this because only the well-established companies were operating. The future was not black, however. The Homestake was doing better, and its neighbor, the Trojan, had reopened. Conditions were already better abroad. More intelligent expenditure of capital was needed to start up new projects and rehabilitate old ones. In this, he thought, the government might help. Recent happenings in the market indicated that capital might be diverted to mining.

"The Western Land Problem" was the topic of the next speaker, Secretary Callbreath. He had discussed it at the

M. W. KRIEGH

meeting of the Western division of the Congress in Spokane on Oct. 1, he said; his address happened to be printed in the current issue (December) of the *Mining Congress Journal;* now he proposed perforce to treat the subject from a somewhat different angle.

The public lands question had been a basic one throughout the country's history, Mr. Callbreath said. He sketched the manner in which it had come down to the present from the time when, after the Revolution, the early states, to help pay the war debt, had transferred their lands to the federal government. After this debt had been paid, public sentiment gradually developed into a demand that the lands should be returned to them, and the federal government had complied, so that the original states regained their territory. New states were formed as time went on, the old problem cropping up continually. Lincoln had held to the doctrine that the public lands were but held in trust for maturing states, and under this policy the West had begun to prosper, the metals and minerals feeding the nation's industry. Then had come Governor Pinchot, with his doctrine of conservation, pointing out the danger of the growth of trusts. This had led to the withdrawal from entry of most of the mineral resources, a condition from which the public land states complained.

A state could not prosper, said Mr. Callbreath, unless it had the power of taxation. But possession of this power meant little if most of the land within the state's borders belonged to the federal government. The latter apparently had been holding to the idea that the public lands in the West belonged to it, said the speaker. He cited several cases illustrating the hampering effect of its desire to withhold them from entry.

Transfer of the surface rights of

these lands to the states in which they were found had recently been proposed by President Hoover, said Mr. Callbreath. This was a long step. But some objected, holding that surface rights should never be separated from underground rights. This, according to Mr. Callbreath, had proved bad in his experience, leading to much trouble. Nevertheless, President Hoover had stretched out the first helping hand in years, and the states and the mining industry, Mr. Callbreath thought, should work with the commission which the President had proposed.

The Western states, the speaker said in closing, should be put on a parity with every Eastern state, each equal to the others in fundamental principles and control of its own affairs. This was impossible, however, so long as the federal government owned most of the land within the state. The Leasing Law was wrong. The federal government should divest itself of these lands (save for the Forest Reserves, as the speaker explained later), and as much land as could be taken up by individuals should be released for entry.

### Aspects of Taxation

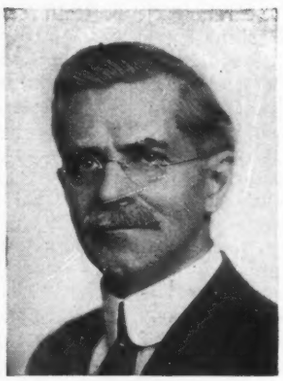
A paper on "Mineral Taxation," by McKinley W. Kriegh, chief of the Tax Division of the Mining Congress, completed the session's program. Taxation presented one of the important trends with which we had been dealing in the last decade, said Mr. Kriegh. The nation's tax bill was now about $8,000,000,000, compared with a few hundred millions about 25 years ago. No one complained about the total, so far as he knew, so long as it was wisely spent on schools, roads, and other things. If there was any complaint it was because one politically favored group had been able to subject another less favored to some special form of taxation. Groups of the latter sort were able to defend themselves only by educating Congressmen and others.

"Of a total taxation revenue amounting to over $3,000,000,000 collected by federal, state, and local governments from business and industrial operations, $778,000,000 is derived from companies engaged in the natural resources and related industries," said Mr. Kriegh. "Of this amount, $506,817,039 is derived from mining, metals, and metal products companies. These figures are compiled from the last statistics of income issued by the Bureau of Internal Revenue. Thus it may be said that the mining industry and manufacturing industries related thereto provide the backbone and afford greater possibilities through development for enlargement of the tax base than any other source of taxation revenue.

"The Federal Congress and the state legislatures should so frame their business and taxation laws as to permit the freest and largest possible development and exploitation of mineral resources consistent with sound public policy and principles of equity as between mine taxpayers and taxpayers in other industries," said Mr. Kriegh. "Congress should provide such measures as will encourage and promote prospecting and exploitation for new deposits and additional reserves, discovery and development of new mines, research and experimentation that will result in the economic utilization of the complex ores and low-grade mineral deposits already known."

### Taxation Theory Should Be Studied

Commenting in general on the papers of the afternoon, Dr. T. T. Read, of the Columbia School of Mines, said that we needed to come to a sounder understanding of the theory of taxation. He reminded the audience of the incidence of taxation in forcing resources into production, so that at times it was almost disastrous for one to find mineral on his property. He agreed with Mr. Callbreath that the federal government should be a government and not a land office, and that it should turn mineral lands back to the states; but might we not be getting from the frying pan into the fire, he asked, because of the forcing of these lands into production through resulting taxation? He reiterated that what was needed was a broader understanding of the relation of the theory of taxation to the fundamental prosperity of the country.



J. F. Callbreath

### Mine Taxation Session Draws Crowd

Mr. Kriegh's paper, presented on Wednesday afternoon, was a forerunner of a lengthy session on "Mineral Taxation" on Thursday. Six papers graced the program, if anything as heavy as taxation may be called graceful. The session resembled a jousting tournament. R. S. Gayton, of the Bureau of Internal Revenue, talked on "Corporate Distributions from Depletion and Depreciation Reserves." H. B. Fernald then told wherein he differed with the Bureau, his specific topic being "Taxable Status of Mining Dividends and Distributions." The issue remained undecided, Mr. Gayton being prevented from replying by the Bureau's rule.

The references to depletion became more pointed. The Joint Congressional Committee on Internal Revenue Taxation, it seemed, had recently received from its staff a so-called "Preliminary Report on Depletion." In this the staff proposed that for the usual methods of charging depletion—namely, either that involving a cost basis or another using a discovery basis—a third method involving a "percentage depletion" basis be substituted. Cases using the cost basis are running out, and although those resting on a discovery basis can be continued as new discoveries are made, the latter method is often not satisfactory. The staff report had suggested that on the proposed new basis depletion be figured annually at approximately 33⅓ per cent of net income before depreciation and depletion. This report formed the basis of the third paper on the program, which was presented by A. P. Ramstedt, controller of the Hercules Mining Company, Idaho. Mr. Ramstedt discussed the report in general, considering whether 33⅓ per cent was the proper percentage. L. C. Graton, of Harvard, then discussed the theoretical basis of percentage depletion. Paul Armitage, of New York, who was on the program to talk on the legal concept of depletion, took the rostrum to say that the fixed percentage basis which had been suggested by Messrs. Ramstedt and Graton (also by the so-called Parker Report) would not be applicable to short life mines. The proposal to substitute percentage depletion was very serious and not likely to be adopted. He termed this basis "counterfeit depletion." He was in favor of retaining all of the present bases for charging depletion and of adopting a form of percentage depletion as an alternative method instead of a substitute. These issues naturally remained undecided when the convention closed, although receiving further consideration later in the day.

### The Machine Myth

The prolonged discussion delayed the presentation of a paper by R. C. Allen on "Analytic Valuations in Income Taxation of Mines," which eventually went on record. Incidentally, Mr. Allen termed the papers on depletion as being among the "most powerful" he had ever heard.

An interesting prelude to the meeting of the National Committee (of coal men) on "Mechanized Mining," on Friday morning, was the presentation of a paper by F. A. Merrick, recently elected president of the Westinghouse Electric & Manufacturing Company. Mr. Merrick dealt with the century-old idea that the machine tended to increase unemployment, or, more fully, that by lessening the amount of manual labor required to perform a single operation it decreased the amount of human labor required by society.

Use of the machine by man was by no means new, he said. The trend to it had become increasingly rapid. It was marked by three spurts—namely, the so-called industrial revolution of the nineteenth century; the electrification of industry beginning in the last decade of the nineteenth century, and, the most pronounced change, since the war.

Before the war electrification had been of a piecemeal sort, but now it was the custom, where possible, to start afresh and redesign everything about a plant, so as to get the lowest operating cost. The tendency to make everything as nearly automatic as possible was well established.

Conditions in Europe formerly and those existing today in the United States were contrasted. Here labor was remarkably mobile, instead of fixed, as on the other side, and the employer was willing to pass on to the workman a share of the profit from mechanization. Higher wages and lower production cost tended to increase buying power and in turn demand, and thus more workers were drawn into production. The foundation of the higher scale of living was the great productivity of the individual made possible by wider use of the machine. And though a temporary glut might occur at times, man had an insatiable desire for goods and would labor to obtain them. As for those who insist that mechanization had increased unemployment and that millions were out of work, the speaker said that the National Industrial Conference Board had found these figures were based on shrinkage in certain industries and that they made no allowance for re-employment.

Mechanization had proved advantageous in metal mining, the speaker said, citing the use of power shovels, haulage, conveying, and various services underground. These all for the purpose of lowering operating costs. In short, said Mr. Merrick, the machine myth had been exploded, and co-operative understanding, if continued, would explode any others that might spring up.

### Aspects of Industrial Progress

Three brief papers marked the closing session, over which Dr. Henry Mace Payne presided. Judge Ira E. Robinson, once identified with War Minerals Relief administration and now a member of the Federal Radio Commission, talked on commissions as an aid to industry and government. They can aid industry only as they assist good government, he said. They must not lose sight of American ideals of due process, orderly procedure, and fair play. They must avoid even the appearance of arbitrary action. Through them enterprises that must submit to government control in the public interest may be regulated with flexibility, quickly, and scientifically.

Paul S. Clapp, of the National Electric Light Association, whose subject was "Electricity the Servant of Industry," said that the 1930 construction programs of electric light and power, street railway, and telephone and telegraph companies, as well as of the electrical manufacturing industry, should encourage copper producers. The electric light and power companies alone would spend $865,000,000 for new construction, in the coming year—an increase of $65,000,000. About 60 per cent of this will be for extending transmission and distributing facilities. Fifty per cent of the copper produced in the United States this year would have been consumed by public utilities and electric manufacturers, the speaker stated.

President Hoover's efforts to ward off industrial depression received attention. Otto T. Mallery, member of the Committee on Seasonal Operation in Construction Industries, spoke on the situation. The conference at the White House was the first time the federal government had stepped into leadership when depression threatened, he said. It was courageous, because if the move succeeded people would say depression had never threatened, and, if it failed, the government would be censured. Mr. Mallery explained why stimulation of construction rather than of something else would play the important part expected. By increasing it a new credit was created. Construction was something wages could not buy. The resultant increased consumer purchasing power would be several times the amount expended.

### The Resolutions

The work of the convention expressed itself in a resolution authorizing a committee to study the evils of overproduction and the hurried exhaustion of natural resources, and to report legislation to correct the situation. Reference was made to the difficulty of meeting the situation of overproduction in mining due to legal restrictions under the Sherman anti-trust law.

The convention backed President Hoover in seeking a solution of the public land situation through the recently created Public Land Commission, but opposed any policy which shall separate surface from subsurface rights of the public lands. Opposition was expressed to proposed legislation forbidding surface rights to lands taken under mining locations in national forests, on the ground that it will injure and embarrass necessary development of the mineral resources of the public land states. Prior opposition to federal legislation regulating the sale of securities was expressed.

Another resolution favored a depletion and depreciation rate of 33⅓ per cent, but preserving to mine taxpayers whose depletion base has been previously established the right to continue depletion under that method.

A banquet, at the Mayflower, marked the end of the convention, as usual. It was novel in its "speechlessness."

Little Rock, Ark., was chosen as the convention city for the Industrial Development Conference to be held by the Southern Division of the Mining Congress next March.

## British Columbia Suffering From Water Shortage

AN extraordinarily dry year, with about only one-third of the normal rainfall in southern British Columbia, has produced a serious shortage of water, and the power companies are hoisting signals of distress. The northern part of the province has not suffered in the same way. The British Columbia Electric Railway Company, the largest purveyor of electric current, has had its steam auxiliary plant in continuous operation for more than a year, and now it has had to issue notice to its customers that, unless there is a continuous heavy rain for several days in the immediate future, serious conservation of current will be necessary. Vancouver already has suspended all but necessary lighting, and the above-mentioned company has curtailed its car service and ceased to heat its cars.

In reply to an inquiry as to how the water shortage will affect the operations of Consolidated Mining & Smelting Company of Canada, S. G. Blaylock, vice-president and general manager, said his company is conserving power by cutting out heaters, boilers, and extra lighting. No men have been laid off, and he hoped it would not be necessary. The company had not been short of necessary power at the smelter to date; in fact, the volume of current used there was about as great as it ever had been. As to the Sullivan mine, Mr. Blaylock said that the East Kootenay Power Company, which supplies the current, has installed a steam plant at Crow's Nest Lake capable of generating 10,000 kw. and Consolidated's own plant is capable of developing 4,500 kw., so even should the Elk and Bull rivers fail, an inconceivable situation, with its share of the power company's current and its own power plant, full production at the Sullivan can be maintained.

## North Butte to Increase Output in January

IN JANUARY, ore shipments from North Butte's Granite Mountain Group, in the Butte district, Montana, will be increased, according to W. P. Jahn, vice-president of the company, who recently visited the property with several large stockholders. At present about 8,000 tons monthly is being shipped and from 400 to 500 men are employed.

Within a short time the orebody on the 3,400 level will be opened and unwatering of the 3,600 level completed. The company will then have nine levels in ore. A shaft will be sunk on the Lynchburg group, lying between the Granite Mountain and Butte & Superior properties, at some time in the future, to explore zinc-bearing ground.

## Trains Running to Lake City

The first train to operate between Sapinero and Lake City, Colo., since cloudbursts washed out the roadbed last August, was run Dec. 3. Protests of mine owners at Lake City, notably Empire Chief Mining and M. B. Burke, who owns the Ute & Ulay property, caused the railroad to reverse its original decision to abandon this spur line.

# Lafayette College Dedicates John Markle Mining Engineering Hall

IN THE presence of more than a hundred visiting delegates from colleges, universities, and industrial organizations, Lafayette College on Dec. 6 dedicated the new John Markle Mining Engineering Hall, now nearing completion on the institution's campus at Easton, Pa. The dedication exercises were held in the college chapel, William O. Hotchkiss, president of Michigan College of Mining and Technology, making the dedicatory address. Following this address, the honorary degree of Doctor of Science was conferred on President Hotchkiss and the degree of Doctor of Laws on Dr. Benjamin F. Fackenthal, Jr., president of the board of trustees of Franklin and Marshall College. The climax to the dedication exercises was the announcement made by President William M. Lewis of Lafayette College, that John Markle, distinguished mining engineer, graduate of the department of mining engineering, Lafayette College, in 1880, and donor of the new $500,000 building, had made an additional gift of $400,000 for the permanent endowment of the college's mining engineering department. President Hotchkiss in his dedicatory address said:

"The vast magnitude of the industries which are based on the mineral wealth of the country, and the tremendous part they play in this most wonderful age of all history, form a conception beyond the capacity of any individual. The great leaders of the past generation have had the opportunity to grow with these industries from their small beginnings to their present great size.

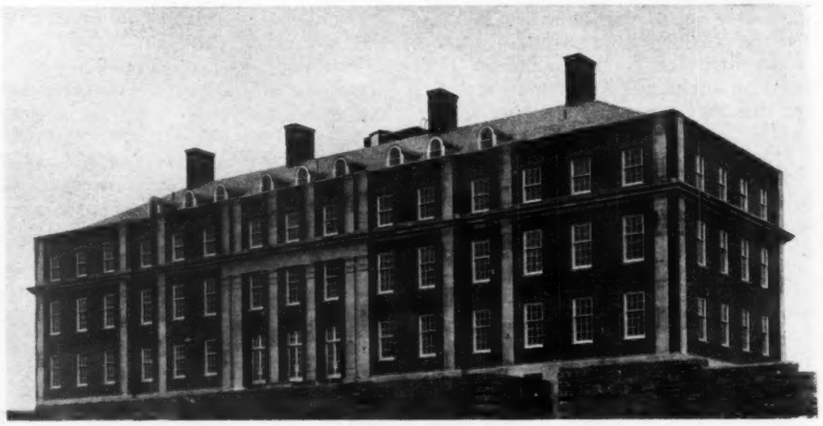
"The leaders of the next generation will start with the handicap of industries already vast, without the opportunity of growing with these industries from small beginnings. The leaders of the future will to a much larger degree be college trained men, because a much larger part of our young men of great native ability are in college than was the case a generation ago. This presents a challenge to the colleges which we of their faculties are bending our best efforts to meet. This great industrial development has been so unprecedented that college faculties can know only imperfectly what should be done to prepare these new leaders most adequately for their tasks. This event is not only of great significance to Lafayette College, but has deeper significance to the great industries which are based on the mineral wealth of the country."

The $500,000 gift of Mr. Markle, said Prof. William B. Plank, head of the department of mining engineering at Lafayette College, in his address at the exercises, is the largest amount that has been expended for a mining engineering building in this country. Referring to the different features of the building, Professor Plank stated that it is rectangular in form, 172 ft. long by 52 ft. wide, with four stories and a basement. The construction is of steel columns and beams, with reinforced concrete floors, the exterior walls being of dark red brick trimmed with hard blue Indiana limestone. On the first floor are two lecture rooms, an ore dressing laboratory, a drafting room, a mining museum, a library, and the main offices. Also on this floor, in the center of the building facing the stadium, is the John Markle Mining Society clubroom.

In the basement are the laboratories for coal preparation, ore sampling, mine safety, mining machinery, mechanician shop, and all of the machinery for the mechanical and electrical services of the building. There are also on this floor, two supply rooms, two research rooms, a balance room, lavatory, shower baths, locker rooms, and a room for a seismograph. The second floor contains laboratories for mineralogy, petrology, general and economic geology, with two lecture rooms, one of which has 140 seats. Here are the offices of the staff in geology and geography and two rooms for the preparation of mineral and rock collections, as well as a private laboratory for research work in petrography.

All work in metallurgy is done on the third floor, where there are laboratories for wet and fire assaying, fuels and refractories, electrometallurgy, pyrometry, and metallography. On this floor are also a fine-balance room, a conference room, and the offices for the staff in metallurgy. On the fourth floor, over the central part of the building, are two rooms with a roof deck overhead. These rooms provide space for meteorological measurements and for the work in astronomy.

Speakers at a spirited luncheon, which followed the dedication exercises, included Harry A. Mackey, Mayor of Philadelphia; United States Congressman W. R. Coyle, of the 30th Pennsylvania Congressional District; Charles R. Richards, president of Lehigh University; E. A. Holbrook, dean of the school of mines and engineering, University of Pittsburgh, and J. V. W. Reynders, past president, American Institute of Mining and Metallurgical Engineers.



*The John Markle Mining Engineering Hall at Lafayette College*

### Mining Education Conference

Many of the delegates and others attending the dedication were present at the conference on "The Relation of Mining Education to Industry" which was held at the college in the morning of the following day, with Prof. William B. Plank presiding. Four papers were presented: "Educational Problems in the Mineral Industry," by Prof. Harry P. Hammond, Brooklyn Polytechnic Institute, and assistant director of investigations, Society for the Promotion of Engineering Education; "Employment, Induction, and Development of Engineering Graduates," by Colonel Robert I. Rees, assistant vice-president, American Telephone & Telegraph Company, and president, Society for the Promotion of Engineering Education; "Training Engineers for the Anthracite Coal Industry," by Cadwallader Evans, general manager, Hudson Coal Company; and "Co-operation Between Mining Schools and the Mineral Industry," by Dean Holbrook, who is chairman of the Committee on Mining Engineering Education of the American Mining Congress.

T. T. Read, professor of mining engineering, Columbia University, and Cadwallader Evans took part in the discussion of the papers, which was led by W. O. Hotchkiss.

### Vocational Symposium

A vocational symposium on "The Choice of a Career" was held in the afternoon, W. E. Vogler, director of the placement bureau, Lafayette College, presiding. A. M. Jones, assistant cashier in charge of personnel, The Chase National Bank, discussed "The Field of Finance and Banking"; Barrett Herrick, general sales manager. Dillon, Read & Company, "Sales"; A. M. Dudley, supervising engineer of development, Westinghouse Electric & Manufacturing Company, "The Technical Professions"; and Earl B. Morgan, consulting personnel engineer, "General Business Opportunities."

## Falconbridge Starts Drilling From 1,000 Level

DIAMOND drilling was started last week from the 1,000 level of Falconbridge Nickel, near Sudbury, Ont. The first hole, which is to be a pilot to determine the dip of the orebody, is expected to cut the ore deposit at a depth of between 1,250 and 1,500 ft., if calculations by company officials are correct. Afterward holes will be put down to explore the outer edge of the norite in its contact with greenstones and quartzites at depths to 3,000 ft. The contract is in the hands of Sudbury Diamond Drilling, and as many as four drills will be in operation at one time at the 1,000 level. Between the 1,000 level and the surface Falconbridge has already one of the longest continuous deposits of proven ore in the Sudbury district, which, if enriched by improvement in grade at depth, could become a factor in the nickel situation, providing a market can be built up in competition with that established by the monopoly of International Nickel of Canada.

The first annual report of Falconbridge Nickel Mines, Ltd., covering operations up to Oct. 31, 1929, will be issued about Dec. 20 and the annual meeting will be held about Jan. 6, 1930.

## Prize Offered for New Uses of Quicksilver

A PECULIARITY of the quicksilver industry is that, with the exception of abnormal war requirements, yearly consumption has been practically unchanged, with only minor upward changes. New uses have barely offset losses in demand from old sources of consumption. To promote scientific research in developing new uses, the Mercurio Europeo, a syndicate of Spanish and Italian producers, has opened an international competition, with a prize of £5,000 for the discovery of a new and important use of quicksilver. Interested parties should write for details to the Mercurio Europeo, Caae Postale, 14,276, Lausanne, Switzerland, or to the Leghorn Trading Company, 59 Pearl St., New York City, which is the agent for the United States and Canada of the Mercurio Europeo.

## Complete Examination of Sudbury Claims

Engineers in the employ of Ventures, Ltd., and Sudbury Nickel & Copper have completed reconnaissances of approximately 8,700 acres of property held by these companies in various sections of the "rim" of the Sudbury basin. This territory is held on account of its nickel possibilities. Extensive maps are now being prepared from notes collected during last summer and autumn, and a systematic campaign of exploratory diamond drilling is planned. The first property to be attacked will be a group of claims purchased from Sudbury Ores, Ltd., lying north of, and adjoining, the Murray mine, owned by International Nickel. The option which Ventures and Sudbury Nickel & Copper held jointly on the Strathcona mine, following diamond drilling, has been dropped.

## C. & H. Suspends Furnace at Michigan Smelter

OPERATION of one of the furnaces at the Calumet & Hecla smelter in the Michigan copper district has been suspended, reducing the smelter capacity by 25 per cent of normal. This step has been taken in accordance with the decision of copper producers to curtail output and thus stabilize the price of the metal. In the mine, men formerly working on production have been transferred to the development projects. Although 200 men have been added to Calumet & Hecla's underground force during the last year, production demands have been so imperative that development has suffered. The most important work is being done in the No. 2 Centennial shaft, in opening several new levels in Allouez ground, and in developing the Calumet conglomerate north of the Red Jacket shaft.

No important discoveries have yet been made at the company's Cliff and Phoenix properties in Keweenaw County. Both diamond drilling and lateral work are being continued, however.

## Roan Antelope Estimates Reserves at 75,000,000 Tons

AT THE annual meeting of Roan Antelope Copper, in London recently, A. Chester Beatty, chairman of the board of directors, stated that the ore reserves proved by drilling along a strike of 16,000 ft. indicated a total of 75,000,000 tons of 3.3 per cent copper ore. This represents only 13 per cent of the total possible ore area at this Rhodesian property. The last official estimate of Roan Antelope ore, made in 1928, was 30,000,000 tons of 3.25. Drilling on the Roan Antelope Extension and Muliashi areas, which Roan Antelope has under option, indicates a total length of ore of seven miles, or 35,000 ft. Mr. Beatty stated he was confident that eventually, from the point both of metal output and earnings, Roan Antelope will be one of the great copper mines of the world.

## Georgia Manganese Plant Starts Production

Operation of the new concentrator of Georgia Manganese & Iron, at White, Ga., has just been started. The plant has an annual capacity of 140,000 tons of ore averaging 40 to 50 per cent metallic manganese. Construction of the plant has taken about a year, following a long period spent in evolving successful methods for treating manganese ore.

## Sunshine Orders New 3,000-Ft. Hoist

INSTALLATION of a new hoist, made by Coeur d'Alene Hardware & Foundry, and capable of operating to a depth of 3,000 ft. in a 60-deg. incline shaft, will be started about April 1 in the Sunshine mine, Coeur d'Alene district of Idaho. Orders for the hoist and equipment have already been placed. It will be operated by a 375-hp. Westinghouse electric motor and will be able to hoist 4 tons at a speed of 700 ft. per minute. The hoist will be installed on the main tunnel level. At present, hoisting at the Sunshine property is through an incline shaft to the 500 level and through a vertical shaft from the 500 level to the tunnel level. The incline shaft is now being raised through from the 500 level to the main tunnel, and all hoisting will be done through this unit. A station is now being cut in the main tunnel to accommodate the hoist.

Development of the mine continues favorable. The new orebody, struck west of the shaft on the 500 level, has been proved for a distance of 375 ft. It averages 4 ft. in width. Development on the 700 level has shown it to have about the same dimensions at that depth, and the west drift on the 900 level is said to have struck the same orebody within the last two weeks.

At present the mill is handling 250 tons daily. A new Hardinge ball mill is being installed which has a capacity of 300 tons daily and which will permit stepping mill capacity up to that point. The two ball mills now in use will then be used as auxiliaries. In addition a new, 300-hp. Worthington air compressor will be provided for mining operations.

## Tin and Potash in Spain

Discovery of substantial deposits of tin in the Province of Viscaya and of potash in Navarre is reported from Spain by C. A. Livengood, commercial attaché at Madrid. Pending investigation of their importance, both zones have been withdrawn from entry. The tin deposit covers an area of 5x50 km. Real Asturiana de Minas has been authorized to issue 25,000,000 pesetas of bonds to finance extension of its operations.

## Prepare to Dismantle Bartlesville Zinc Smelter

Dismantling of the Bartlesville zinc smelter, owned by Bartlesville Zinc, subsidiary of American Metal, at Bartlesville, Okla., will be started immediately by Sonken & Galamba, contracting firm of Kansas City. This plant, idle for the last three years, had a capacity of 40,000 tons of charge annually in six distillation furnaces. Work of dismantling will take about six months, Blackwell Zinc, at Blackwell, Okla., is now American Metal's chief producing plant in this area.

## Colorado-Mexico Opens Orebody for 700 Ft.

DRIFTING on the 500 level of the Melville mine, one of the Iowa-Tiger group in Silver Lake Basin, near Silverton, Colo., has shown ore for 700 ft., according to G. R. De Beque, vice-president and general manager of Colorado-Mexico, which operates the property. The ore is of good milling grade and carries gold, silver, lead, and copper. When work was started, the Melville shaft was only 400 ft. deep. After unwatering, it was sunk to the 500 level. Development has also showed a new vein, which joins the Melville. It has been drifted on for a short distance and varies from 2 to 4 ft. in width. Copper and gold are the predominating metals.

For the last year, Shenandoah-Dives has been operating the Iowa mill under lease, although ore from the Colorado-Mexico properties has been treated under a joint arrangement. New equipment, consisting of a ball mill, concentrating tables, and flotation machines, has improved extraction from its former average of 40 to 60 per cent to about 90 per cent of the total metal content. Shenandoah-Dives will vacate the mill, which has a capacity of 100 tons daily, on Dec. 15, and Colorado-Mexico will then take possession. It will treat 75 tons of ore daily at first, tonnage gradually being increased to capacity. The two-mile tramway connecting the mine and mill has been repaired.

## Wright Buys Calaveras

In settlement of existing debts of the Calaveras Copper Company, its properties were transferred for a reported consideration of $250,000 to John P. Wright, representing a group of capitalists. This amounts to a reorganization of the company. The existing option under which the property at Copperopolis, Calif., is being worked by the Engels Copper Company continues under the reorganization plan.

## Test Complex Manganese Ore

D. B. Gemmill and associates, of Prince Consolidated Mining, Pioche, Nev., are conducting an extensive series of tests in the new pyrometrical laboratory of the University of Utah, in co-operation with the U. S. Bureau of Mines station, on removal of lead, zinc, and manganese from low-grade iron manganese ore by the volatilization process. The company has 1,500,000 tons available at present.

## Royal Tiger Reduces Force

Development work on the Royal Tiger properties in the Breckenridge district, Colorado, will be continued during the winter, but the number of men employed has been reduced to 50. Ore on the properties is lead-zinc. Tests are being made to determine the most effective method of exploitation.

# Leaders of Industry Confer in Washington on Stock Crash and Prosperity

PAUL WOOTON
*Special Washington Correspondent*

A GIGANTIC stride toward "systematically spreading into industry as a whole the measures which have been taken by some of our leading industries to counteract the effect of the recent panic in the stock market," as the President phrased it, was taken at the Dec. 7 conference of industry in Washington. Never before in America's industrial history has such a complete cross-section of the nation's business gathered together for conference. In his address President Hoover did not attempt to hide the fact that unemployment exists and that there is a smaller demand for certain types of goods. He pointed to the Federal Reserve System as the first line of defense. The next maneuver to prevent lack of confidence was to secure pledges from leading employers that no movement to reduce wages would take place and to obtain corresponding assurances from labor leaders that they would co-operate to prevent labor conflict.

The purpose of the conference, the President pointed out, was to organize construction and maintenance work to take up any slack in employment which may arise. He made the statement without qualification that "temporary speeding up to absorb idle labor brings great subsequent benefits and no liabilities." Another point made by the President, to which significance is attached, is his assertion that production of consumable goods beyond the daily demand is not advocated.

Dr. Julius Klein, Assistant Secretary of Commerce, in the course of his address, said, "Above all things, our export effort should not be casual or take on the remotest semblance to a dumping campaign. Nearly every desirable market abroad is well protected against such procedure by legislation which would immediately be brought to bear and would discredit not only the individual traders involved but all American export in the given region."

A major element of strength in our economic position is the fourteen thousand million dollars we have invested abroad, he said. We can assure the maintenance and further development of our foreign trade through legitimate, constructive acceleration of these holdings.

Radio, air mail, and telephones provide a fine nervous system for business, which is infinitely closer knit than at any other emergency in history. Continuing, Dr. Klein emphasized the improved quality and increased influence of the business press. He stressed the need for checking distribution wastes and warned against any emotional extreme of hoarding or extravagance.

At present, Secretary Lamont said in his talk to the conference, more equipment orders are on hand and in prospect than at any time in several years. We have learned that, when necessary, it is better to reduce hours than wage rates, he said. If worse comes to worst it is advisable to alternate men by the week, giving some income to as many as possible.

Julius H. Barnes, chairman of the Board of the U. S. Chamber of Commerce, saw in the conference an epoch-making event in the evolution of modern industry. Public confidence is industry's greatest asset, he said—an asset attained in recent years by the development of established ethics and standards and in the formulation of fair business practices. Agriculture is being restored to a fair relationship with other industry. Current commercial news records unexampled instances of extra dividends, as well as an unprecedented number of initial dividends.

President Butterworth of the National Chamber called attention to the war service of industry as an example that business has a fine capacity for team play. Out of that era, he said, grew widespread industrial co-operation through trade associations, encouraged as it was by the leadership which came to the Department of Commerce in the post-war period. The man who helped so greatly to make trade associations serve the public so well is now the national Commander-in-Chief. When others were pausing, he recalled, President Hoover was acting to restore confidence.

### Industrial Press Lauded as Stabilizing Factor

IN HIS address at the conference of business leaders in Washington on Dec. 5, Dr. Julius Klein, Assistant Secretary of Commerce, pointed out that an important factor contributing toward the success of any such undertaking as that which is now engaging the attention of business leaders is the vastly improved quality and increased influence of the industrial press. A short while ago, he pointed out, only a few large corporations permitted any considerable collection of reliable trade and industrial data. Today, the keen acumen of industrial editors and their expert staffs has made the sequestration of any important economic facts very difficult, if not impossible, he declared.

# Toronto Letter

*By Our Special Correspondent for Northern Ontario*

## Canada Revises Depletion Rates Upward for Base-Metal Properties

TORONTO, Dec. 7, 1929.—The Department of National Revenue, at Ottawa, has changed its practice in connection with the depletion allowance for base-metal mines. Formerly, 50 per cent of the net taxable income was allowed for precious-metal mines and 25 per cent of the net taxable income in estimating the depletion allowance of base-metal mines. Where base-metal ore carried a considerable quantity of precious metals, the depletion rate was decided after taking the two rates into consideration, and of course it is always difficult to decide what portion of the profits are attributable to the precious-metal contents. The department now announces that starting with the taxation year of 1929, the depletion rate will be increased from 25 per cent to 33⅓ per cent on the mining profits of base-metal companies. This rate of 33⅓ per cent will also cover any precious metals that may be recovered during base-metal mining operations. Shareholders of these companies will also be allowed 33⅓ per cent for dividends from such companies, as a return of capital. This will, of course, in no way affect the 50 per cent depletion allowance for gold and silver mines, nor the right of shareholders to take the 50 per cent depletion on dividends from gold and silver mines.

ARRANGEMENTS have recently been completed to have a power line run to the Granada Rouyn property, in the Rouyn district, Quebec. With additional power, development will be increased and the shaft will be sunk below 625 ft. At this point three veins carrying ore have been proved to date, and exploration is now under way on a fourth. An estimate of 70,000 tons of $15 ore proved to date has been made by the president. The company is considering construction of a 100-ton mill. To provide funds, a reorganization plan has been proposed whereby a new company, with a capitalization of 1,000,000 shares, would exchange one of its shares for each ten held by present stockholders. This would leave 500,000 shares in the treasury for financing.

Development on the 725 level shows a considerable improvement in the San Antonio gold mine, in southeastern Manitoba. Grade, width, and length of ore are all better than on the 600 level. Recommendation has been made that the shaft be deepened to 975 ft. and two new levels opened up. Mill construction will depend on this work.

At Morrison Mines, in the Gowganda district of northern Ontario, high-grade silver ore has been found on the 425 level. Drifting has proved it for a length of 20 ft. This is the first new silver discovery for some time, although other Gowganda mines have been mining very rich ore. At the Miller Lake O'Brien, in fact, some ore recently found was so rich in silver that it could not be put through the crusher.

## Good Attendance at Canadian Institute Vancouver Meeting

ATTENDANCE at the meeting of the local branch of the Canadian Institution of Mining and Metallurgy, in Vancouver, B. C., was extraordinarily good. About 250 delegates from different parts of the province were present on Nov. 27-29. The chairman, J. D. Galloway, Provincial Mineralogist, reviewed the mining situation in the province during the year. Lack of response from several producers to inquiries as to production prevented his making any but a rough estimate of the probable production. He placed it at about $70,000,000, which, if realized, will make a new high record.

Papers presented covered lode and placer mining, cable tramway construction, milling of silver-lead-zinc and copper ores, production of gypsum, mining and dressing of coal, industrial application of pulverized coal, and the Turner Valley oil field. Guests at the banquet that wound up the session included Lieutenant-Governor R. R. Bruce, Premier S. F. Tolmie, and Minister of Mines W. A. McKenzie. The Premier and Minister of Mines reiterated a promise that the mining laws of the province would not be changed without consulting operators.

## Build Smelter at Boliden, Swedish Copper Mines

An important addition to the Swedish mining industry is the Boliden mines, situated in Vesterbotten, at the Gulf of Bothnia. The field was discovered in 1924. A smelter is under construction.

The average grade of the ore is 4 per cent copper, ⅓ oz. of gold, and 3 oz. of silver per ton. Samples run as high as 2 oz. of gold per ton, which has given the mine the name of "The Swedish Klondike."

The smelter, being built at the sea coast, at Rönnskär, is expected to treat 400 tons of ore per day. It is equipped with two Cottrell treaters and a stack, 145 m. high, said to be the highest stack in Europe. For the last three years a small tonnage of high-grade copper ore has been sent to an American smelter.

## Empire Zinc Mill Starts

Operation of the new Empire Zinc underground concentrator, at Gilman, Colo., was started late in November. About three cars of zinc concentrate a week are being sent to Illinois plants. Lead concentrate will be shipped to the American Smelting & Refining plant at Leadville. The capacity of the plant is 600 tons daily.

# Mexico City Letter

BY W. L. VAIL
*Special Correspondent*

## Central Selling Agency and Mining Bank Suggested to Aid Industry

MEXICO CITY, Dec. 7, 1929.—Among the suggestions made for alleviating the mining situation, which has been complicated by low prices, exhaustion of several old mines, and the power situation in Chihuahua, is the formation of a federal buying and selling agency that would regulate prices to some extent. Coupled with this suggestion is one for the formation of a mining bank, sufficiently well financed to be able to lend money to needy, and deserving, operators. Such a scheme has already been tried out in Chile, with some success. Whether need for such extreme steps exists is questionable, however. Production has fallen off, of course, but the revolution and the power shortage account for the larger part of the decline. The biggest factor in the present uncertain conditions is probably the labor legislation still before Congress.

NEGOTIATIONS for the purchase of the Boleo copper mines, at Santa Rosalia, Lower California, are said to be under way by American interests. At present the company is controlled by French financiers. Profits for the last fiscal year were reported at about 17,000,000 francs from a production of about 12,000 tons of copper. Reserves are said to have been increased by drilling on the Santa Agueda vein, where high-grade ore is indicated.

In Chihuahua, several companies are endeavoring to ameliorate the unemployment situation by working the men from four to five hours daily for four to five days a week. Power shortage has made this the only alternative to discharging surplus labor.

Santa Rosa Mining, which owns properties near Concepcion del Oro, Zacatecas, has suspended operations. The company produces gold-silver-lead ore and has been operating a small cyanide mill for many years. It is a subsidiary of Exploration, Ltd.

The lead smelter constructed at Mazatlan, Sinaloa, by Belgian interests will be blown in during December, according to the most recent reports. This plant was constructed last year, but starting of operations has been delayed for some time. It will handle only about 20 tons daily at the start, being gradually stepped up to 100 tons.

An exhaustive study of a hitherto unexplored region in the heart of the Sierra Madres, in the states of Michoacan and Guerrero, will be made by the government. This district has practically been untrod by white men. Hopes are entertained for finding important mineral deposits, particularly gold.

# MARKET AND FINANCIAL NEWS

## Zinc Stocks Up Despite Decline in Production

ZINC stocks in the hands of producers at the end of November were 63,061 tons, a gain of 5,945 tons compared with the figures for the preceding month, according to the American Bureau of Metal Statistics. Stocks a year ago were 46,542 tons.

Production showed a drop in November, the total for the month being 47,620 tons, against 50,938 tons in October. Total shipments during the month amounted to 41,675 tons, all but 39 tons being for domestic account.

Zinc output in the United States for the eleven months ended Nov. 30 totaled 579,472 tons, against 569,004 tons in the corresponding period of 1928. Zinc statistics for the eleven months, in tons, follow:

| | Production | Shipments | Stocks |
|---|---|---|---|
| Jan. | 49,709 | 49,732 | 45,418 |
| Feb. | 48,154 | 32,952 | 40,620 |
| March | 55,471 | 58,129 | 37,962 |
| April | 54,653 | 58,027 | 34,588 |
| May | 56,958 | 57,720 | 33,826 |
| June | 52,953 | 49,847 | 36,932 |
| July | 54,441 | 47,251 | 44,112 |
| August | 55,290 | 51,579 | 47,833 |
| Sept. | 53,285 | 47,755 | 53,363 |
| Oct. | 50,938 | 47,185 | 57,116 |
| Nov. | 47,620 | 41,675 | 63,061 |

Concentrate production in the Tri-State district for the January-November period amounted to 590,970 tons, against 585,790 tons for the whole of 1928, and 694,100 tons in 1927.

## Alaska Juneau Profit for Eleven Months Up

ALASKA JUNEAU Gold Mining for the eleven months ended Nov. 30, 1929, reports a profit of $1,088,650 after deducting interest and Ebner mine development charges, but before depreciation, comparing with $880,600 in same period of 1928. Statement for November and eleven months follows:

| | 1928 | 1929 |
|---|---|---|
| November gross | $227,500 | $309,000 |
| Profit | (a) 28,500 | 125,500 |
| Eleven months gross | 2,977,500 | 3,202,000 |
| Profit | (a) 880,600 | 1,088,650 |

(a) After interest and Ebner mine development charges, but before depreciation.

## Contract Prices Named in Ferro-Alloys for 1930

CONTRACT prices of ferro-alloys for 1930 delivery have been announced and reveal a reduction in ferromanganese of $5 a ton, establishing the market at $100, f.o.b. furnace. Silicomanganese, 2½ per cent carbon, is quoted for delivery next year at $135 per ton, a decline of $10; 1 per cent carbon also was lowered $10, bringing the price to $145.

Low-carbon ferrochrome, maximum 2 per cent carbon, is quoted at 17½c., a decline of 1½c.; maximum 1 per cent carbon is offered at 26c., a decline of 3c. from the former level. Prices named on ferrosilicon, ferrovanadium, and high carbon ferrochrome are unchanged.

## American Metal Company in Favorable Position

DR. OTTO SUSSMAN, president of The American Metal Company, Ltd., says that net quick assets of his company are approximately $31 per share of common stock. During the last few years it has acquired very substantial intersets in new copper mining enterprises destined to become important producers. Because of the time required to equip these properties for production on the scale at which operations must be carried on, the company cannot expect earnings from these investments before three years. In the meantime the investments are carried on the company's books at cost.

## Ontario Mining Dividends

The year-end dividends for Ontario metal mines amount to a total of $7,663,898, as shown in the following table:

| | Payable | Amount | Total |
|---|---|---|---|
| McIntyre | Dec. 2 | 25c. | $199,500 |
| Dome | Jan. 20 | 25c. | 238,333 |
| Hollinger | Dec. 2 | 5c. | 492,000 |
| Hollinger | Jan. 31 | 5c. | 492,000 |
| Mining Corporation | Dec. 19 | 12½c. | 207,506 |
| International Nickel | Dec. 31 | 25c. | 3,439,552 |
| Noranda | Jan. 2 | 75c. | 1,680,436 |
| Lake Shore | Dec. 16 | 30c. | 600,000 |
| Teck-Hughes | Feb. 1 | 15c. | 716,571 |
| Nipissing | Jan. 20 | 7½c. | 190,000 |
| Total | | | $7,663,898 |

THE STANDARD STOCK AND MINING EXCHANGE of Toronto recently adopted the general policy of not permitting the purchase of shares selling at 60c. and under on margin. A new system of audits is to be instituted by the exchange which will reveal to the directors the general position of its members. These innovations are made with a view to restoring confidence in the exchange, which has suffered somewhat in recent months because of the general decline in securities values.

MANGANESE IMPORTS during October amounted to 24,867 tons. Imports by countries were: Brazil, 12,889 tons; Russia, 7,009 tons; Gold Coast, 2,800 tons; British India, 2,080 tons; Canada, 49 tons, and Cuba, 40 tons.

## Canadian Company Formed by National Lead

THE National Lead Company has formed the National Lead Company of Canada, Ltd., a subsidiary to take over several large lead properties in the Dominion. The parent company will own all of the capital stock of the Canadian subsidiary, amounting to $5,000,000.

Creation of the new company marks expansion of the National Lead Company in the Canadian field, which it invaded some time ago when it acquired control of the Hoyt Metal Company, of Canada. The National Lead Company of Canada, Ltd., has acquired all of the capital stock of the Canada Metals Company, Ltd., which has plants in Toronto, Montreal, Winnipeg, and Vancouver. It also is the owner of the capital stock of the Great Western Smelting Company, Ltd., which has a plant in Vancouver.

W. C. Beschorman, vice-president of the parent company, has been made president of the new company. G. F. Hoyt, manager of the Hoyt Metal Company, Ltd., is vice-president, and E. J. Cornish, president of the National Lead Company, becomes the chairman of the board of the Canadian company.

UNITED VERDE EXTENSION produced 4,776,000 lb. of copper in November, against 6,038,000 lb. in the preceding month, and 5,141,350 lb. in September.

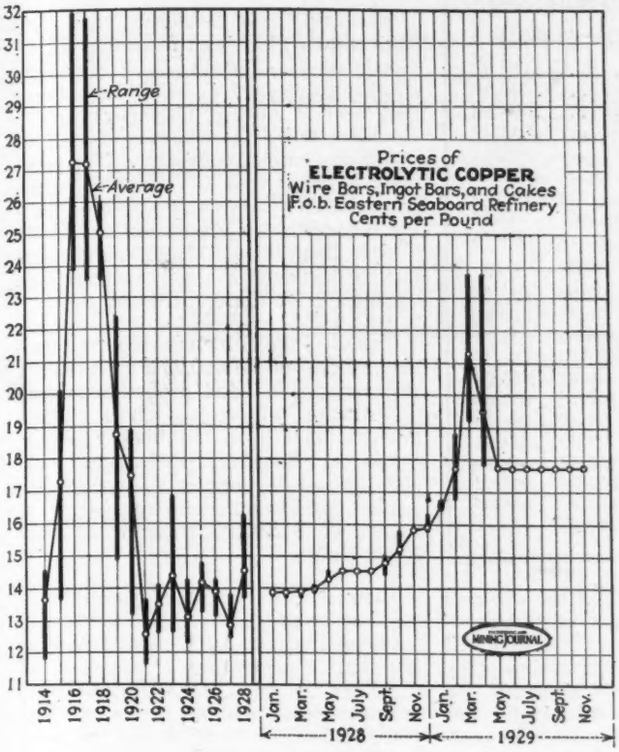
CONSOLIDATED AFRICAN SELECTION TRUST, LTD., reports net profit for the year ended June 30 of £207,200 after providing for London administration expenses and writing off expenditures on investigations and premium on debentures redeemed.

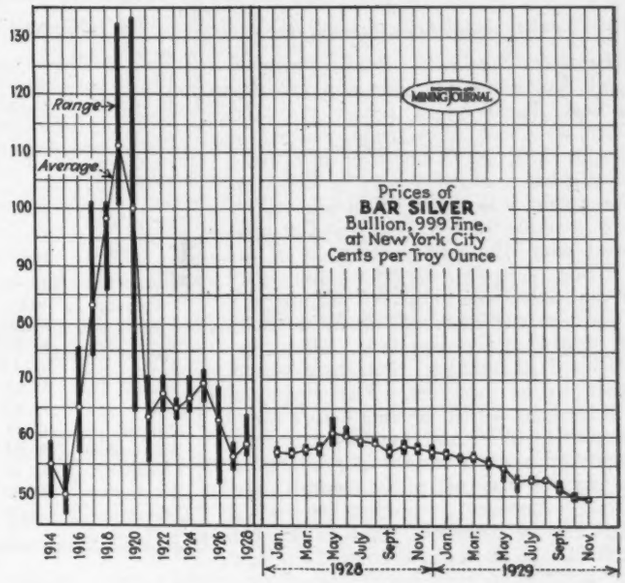
IRON ORE SHIPMENTS from the Lake Superior district will establish a new high mark this year. In 1916, the record year, 64,734,000 tons were shipped, whereas to Nov. 1 this year 61,253,000 tons went down the Lakes. About 5,000,000 tons will be moved in November, to which must be added about 1,500,000 tons shipped all-rail.

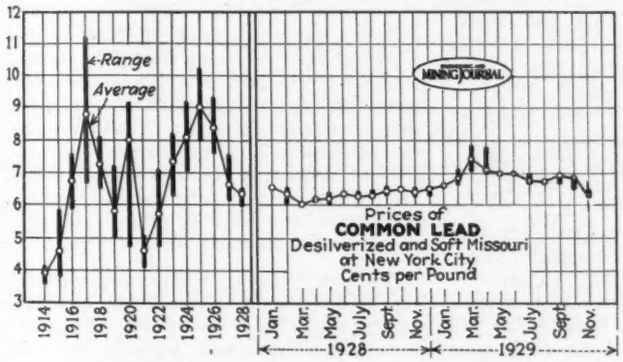
CALLAHAN ZINC-LEAD COMPANY reports for the quarter ended Sept. 30 a loss of $14,204 after development costs, expenses and other charges, but before depreciation and depletion, against a net loss of $7,236 in the preceding quarter. Net loss for the nine months this year was $47,012.

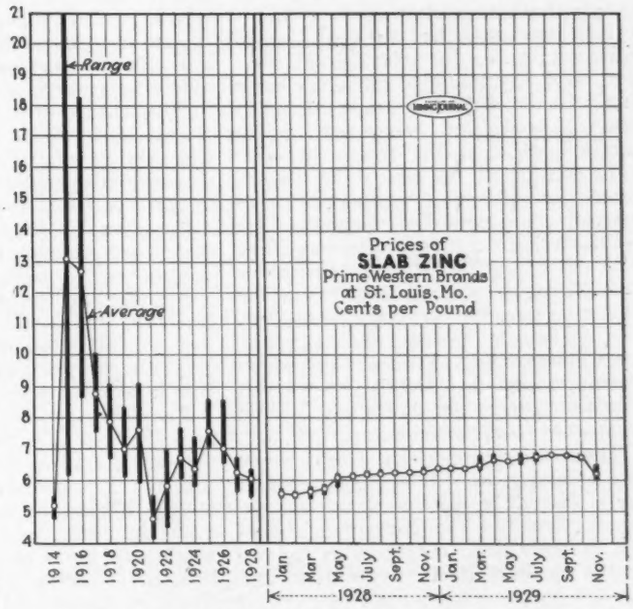
THE MCINTYRE PORCUPINE MINES reports for the quarter ended Sept. 30 net earnings, before plant depreciation, of $498,362. Gross income for the quarter was $1,112,861.

# Metal Price Curves

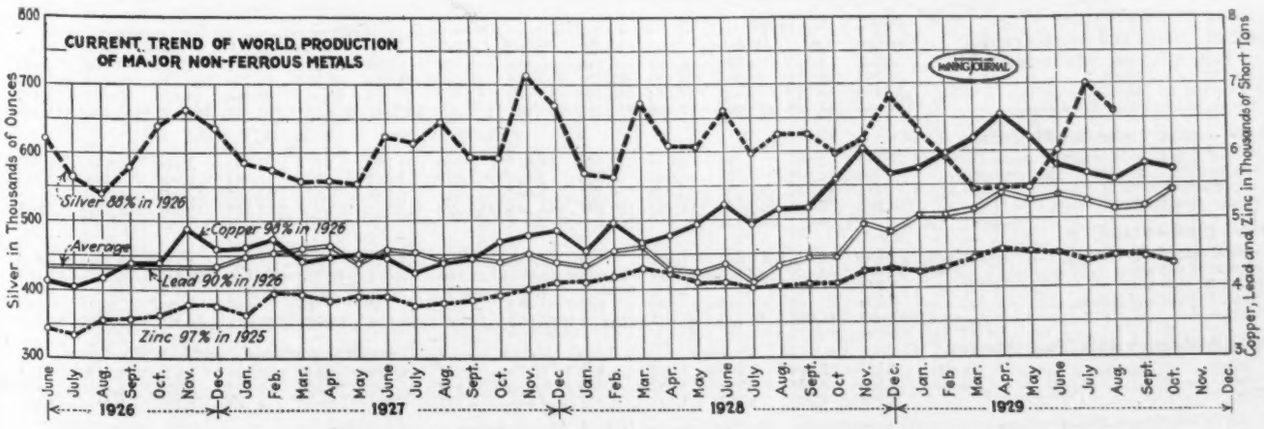



THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
MINING JOURNAL
Silver in Thousands of Ounces
Copper, Lead and Zinc in Thousands of Short Tons
Silver 88% in 1926
Copper 98% in 1926
Average
Lead 90% in 1926
Zinc 97% in 1925
June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct Nov. Dec. Jan. Feb Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1926
1927
1928
1929

## Tin Producers Face Big Job in Reducing Output

W. A. Doman
*Special London Correspondent*

London, Nov. 26, 1929 — Quite a spurt has taken place in tin and tin-mining shares by a report that the Tin Producers' Association, formed in August last, is to consider a scheme for the rationalization of the industry. The report was to the effect that at the next meeting of the association a proposal would be put forward for a restriction of production to the extent of 10 per cent, and that all the British Empire producers would join and would be supported by outsiders. From inquiries I have made, this story would appear to be incorrect. The producers will have no settled scheme before them for consideration, and they have not even suggested any restriction of production. In fact, the majority of the members are strongly opposed to such a means of assisting the industry. Last week I referred to the matter, and pointed out that the association was not contemplating puting up money to relieve any person or firm that was holding up the metal.

The association has suffered a good deal of criticism for its apparent inaction, and has come to the conclusion that something must be done. Restriction of production being out of the question, owing to the diverse interests to be considered, the next thing investigated was selling. Nigerian producers scarcely count nowadays, owing to their relatively high cost of production. The difficulty facing the Malayan companies is to induce the Chinese owners and the Dutch companies to come into line. Just so long as it suited their purpose, the Chinese might agree, and in certain circumstances the Dutch government would not hinder the Banka and Billiton companies from participating.

The selling proposition comes down to a smelting one. It is suggested that there should be no restriction at the mines, but that the companies should deliver their usual quantities of tin ore to the smelters, both in the East and also in this country. Then the smelters are to see what market requirements may be, and to withhold an undetermined proportion of each parcel received. If, say, 10 per cent were withheld, the smelters would be allowed a higher returning charge on the 90 per cent sold. The stock would be disposed of as and when convenient. The question is asked why any company should produce what it will not be able to sell and to pay some other company to store it. But the cynics go further than this. They do not trust one another. What is there, they say, to prevent a company that produces in the ordinary way 100 tons a month from sending to the smelters 110 tons, and thus still getting the benefit of the 100 tons sold?

Another aspect of the problem that presents itself is as to the concentrates; they are not all of the same value.

While I was discussing the scheme with a mining engineer yesterday, he made the remark that if the companies would only agree to stop work on Sundays, the problem might be solved.

### *E.&M.J.* Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

| | |
|---|---|
| 1920 | 130.92 |
| 1921 | 80.80 |
| 1922 | 93.94 |
| 1923 | 103.43 |
| 1924 | 102.63 |
| 1925 | 111.74 |
| 1926 | 107.74 |
| 1927 | 97.54 |
| 1928 | 99.78 |

| | 1927 | 1928 | 1929 |
|---|---|---|---|
| January | 100.46 | 97.54 | 106.86 |
| February | 100.01 | 96.73 | 110.37 |
| March | 100.84 | 96.22 | 122.71 |
| April | 98.63 | 97.14 | 116.36 |
| May | 96.41 | 99.05 | 110.03 |
| June | 95.55 | 100.16 | 109.66 |
| July | 95.42 | 99.69 | 109.58 |
| August | 97.25 | 99.85 | 109.81 |
| September | 96.01 | 100.53 | 109.29 |
| October | 95.36 | 102.34 | 108.52 |
| November | 96.22 | 103.83 | 106.09 |
| December | 98.30 | 104.28 | ..... |

## Ardsley; Texas Gulf; Vipond; Butte & S.; Walker

Ardsley Butte Corporation, a holding company, has been formed by L. O. Goodman, T. Tomich, S. E. Crocker, R. E. Sawyer, and associates to acquire and operate mining properties in the Boulder Batholith section of Montana, of which Butte is the center. The company is capitalized at 7,500,000 shares, par value $1. It expects to absorb Ardsley Butte Mines Corporation and Butte Copper Consolidated Mines and is offering stockholders of these companies an even share for share exchange.

Texas Gulf Sulphur reports October profits of $1,420,959. November shipments, sales, and profits, according to estimate, will exceed those of any previous month in the history of the company. Based on orders on hand and indicated shipments during December, profits for the year will be in excess of $15,600,000, or more than $6 per share.

Vipond Consolidated, operating in the Porcupine district of Canada, reports gold output for the fiscal year of $797,113, representing a recovery of $7.93 per ton from 100,540 tons. This compares with $646,896 in the previous year, a recovery of $7.46 per ton from 86,727 tons milled. Operating profit, before depreciation, was $300,544, compared with $185,930 last year.

Butte and Superior Mining Company for quarter ended Sept. 30 reports a profit of $12,955 after expenses and taxes, but before depreciation and depletion, against a profit of $40,554 in the preceding quarter and a loss of $13,700 in the third quarter of last year. The profit for the nine months ended on Sept. 30 was $37,886, against $48,020 in the corresponding period last year.

Walker Mining Company, operating in California, reports for quarter ended Sept. 30 a profit of $248,652 after inventory adjustments, depreciation and interest, but before depletion and federal taxes.

## Current Statistics of Production and Stocks of Copper, Lead, and Zinc

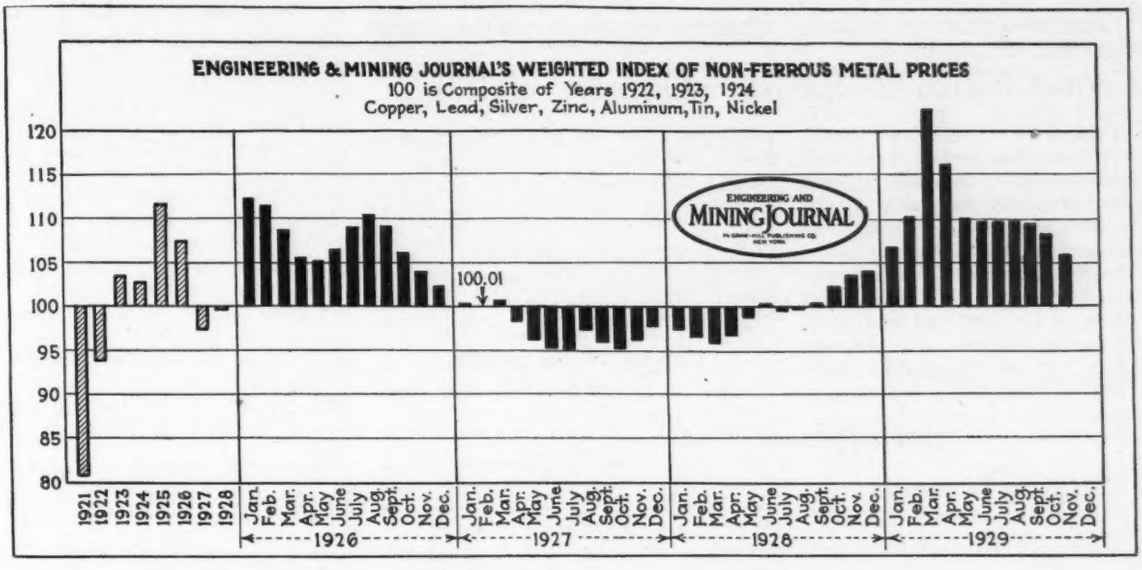
Data from American Bureau of Metal Statistics

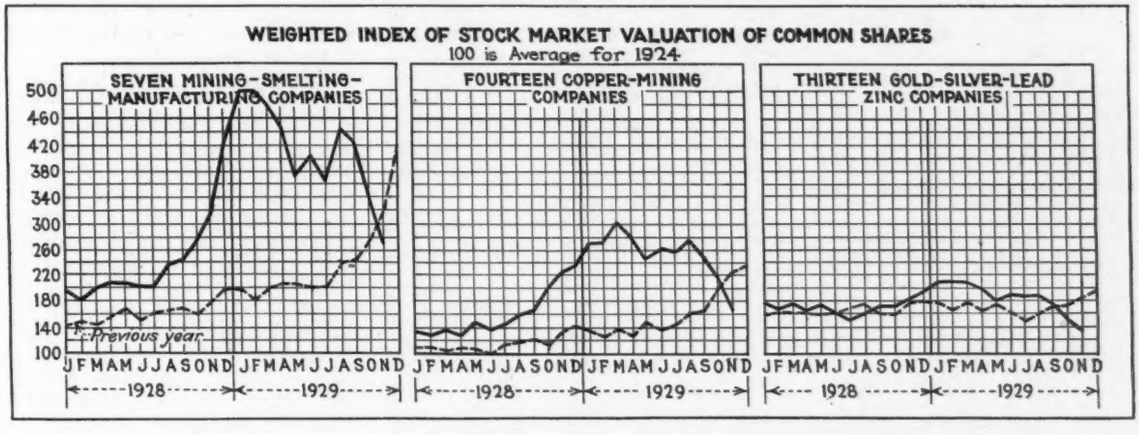
*Figures Represent Short Tons*

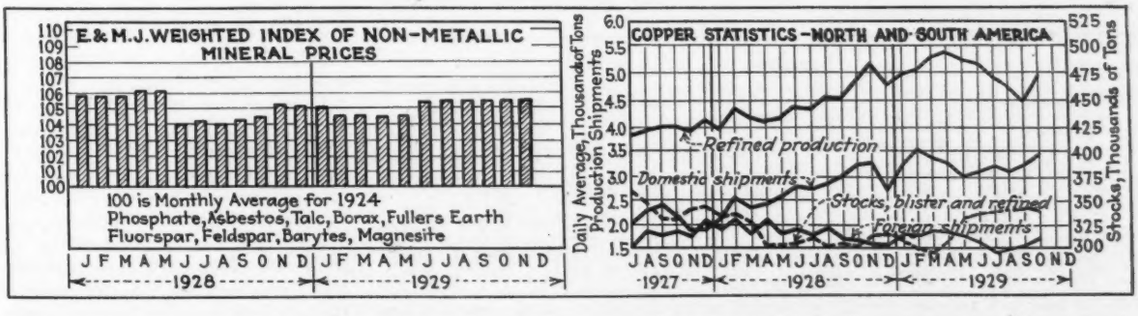
| | 1927 | 1928 | | 1929 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COPPER—North and South America** | Average | Oct. | Average | Jan. | Feb. | March | April | May | June | July | August | Sept. | Oct. |
| Production, refined, daily average | 4,045 | 4,813 | 4,448 | 4,983 | 5,049 | 5,276 | 5,378 | 5,219 | 4,630 | 4,952 | 4,795 | 4,478 | 4,930 |
| Domestic shipments | 68,737 | 100,371 | 81,955 | 100,135 | 98,771 | 105,860 | 99,051 | 93,743 | 95,258 | 98,720 | 96,970 | 98,043 | 105,729 |
| Foreign shipments | 53,489 | 54,992 | 57,185 | 57,054 | 50,150 | 59,946 | 57,708 | 55,123 | 48,461 | 40,204 | 45,035 | 45,921 | 53,461 |
| Stocks, blister and refined | 335,311 | 287,380 | 300,771 | 307,959 | 296,298 | 295,309 | 311,003 | 332,641 | 334,621 | 337,199 | 346,050 | 347,436 | 343,349 |
| **LEAD—United States and Mexico** | | | | | | | | | | | | | |
| Production, smelter, daily average | 2,513 | 2,603 | 2,514 | 2,656 | 2,559 | 2,617 | 2,720 | 2,792 | 2,777 | 2,723 | 2,556 | 2,631 | 2,773 |
| Production, U. S. mines, daily average | 1,798 | 1,875 | 1,785 | 1,891 | 1,723 | 2,118 | 2,083 | 2,067 | 1,925 | 1,881 | 1,904 | 1,893 | 1,983 |
| Imports into U. S. A. | 13,451 | 15,350 | 12,757 | 22,924 | 9,551 | 8,383 | 7,115 | 6,944 | 9,412 | 12,572 | 12,493 | 8,515 | ..... |
| Stocks, smelter and refinery | 156,878 | 152,746 | 160,511 | 156,182 | 160,597 | 158,149 | 156,888 | 162,255 | 173,612 | 173,549 | 175,641 | 168,707 | 167,023 |
| **ZINC—United States** | | | | | | | | | | | | | |
| Production, daily average | 1,681 | 1,621 | 1,693 | 1,604 | 1,720 | 1,790 | 1,822 | 1,837 | 1,708 | 1,756 | 1,783 | 1,776 | (b) 1,643 |
| Domestic deliveries | 45,811 | 50,126 | 48,301 | 47,677 | 51,057 | 56,267 | 56,558 | 56,614 | 47,973 | 46,570 | 50,610 | 46,287 | 47,184 |
| Exports, slab zinc | 3,468 | 884 | (a) | (a) | (a) | (a) | (a) | (a) | (a) | (a) | (a) | (a) | (a) |
| Exports, ores and dross | 4,424 | 90 | 453 | 545 | 165 | 483 | 308 | 358 | 266 | 537 | 173 | 211 | 247 |
| Stocks | 37,602 | 46,068 | 44,333 | 45,418 | 40,620 | 37,962 | 34,588 | 33,826 | 36,932 | 44,122 | 47,833 | 53,363 | 57,116 |
| **World Production Rate (Daily Average)** | | | | | | | | | | | | | |
| Copper | 4,543 | 5,698 | 5,236 | 5,767 | 5,968 | 6,219 | 6,561 | 6,213 | 5,820 | 5,624 | 5,623 | 5,818 | 5,751 |
| Lead | 4,514 | 4,937 | 4,976 | 5,037 | 5,068 | 5,176 | 5,418 | 5,440 | 5,467 | 5,277 | 5,200 | 5,301 | 5,468 |
| Zinc | 3,910 | 4,223 | 4,271 | 4,231 | 4,357 | 4,448 | 4,537 | 4,528 | 4,483 | 4,388 | 4,397 | 4,437 | 4,377 |

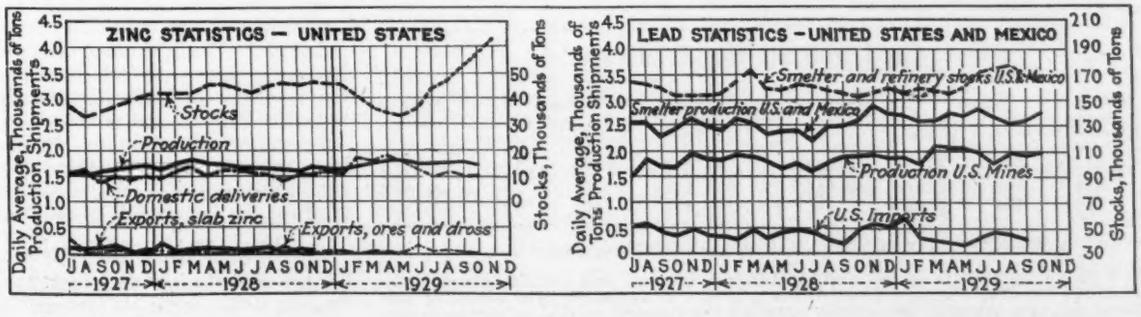
(a) Withheld pending investigation of government reports. (b) Zinc produced in U. S. from Mexican ore not included.

# *E. & M. J.* Statistics of the Mining Industries





E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth
Fluorspar, Feldspar, Barytes, Magnesite
COPPER STATISTICS - NORTH AND SOUTH AMERICA
Daily Average, Thousands of Tons Production Shipments
Stocks, Thousands of Tons
Refined production
Domestic shipments
Stocks, blister and refined
Foreign shipments
1927
1928
1929



# The Market Report

## Good Sales in Lead—Copper Quiet

*New York, Dec. 11, 1929.*—Transactions in non-ferrous metals were confined chiefly to lead, the sales of that metal being well above the average for a single week's business. Copper for domestic account was extremely quiet, though inquiry here and there showed some improvement. Slightly lower prices obtained for zinc, but this failed to arouse buying interest. Tin also was dull, traders here paying but little attention to reports from the other side on the latest move for restricting production. The price of platinum was reduced to $63 an ounce by leading sellers, a decline of $2 from the previous quotation. The federal government lent some support to the silver market by a large purchase, but the effect was only temporary. Both quicksilver and antimony were quiet at virtually unchanged prices.

### Copper Holds at 18c.

Sales of copper for the week indicated that consumers continued in their policy of restricting business to a minimum. The November statistics, to be released tomorrow, had some influence on the market, as it was apparent that they would show a substantial increase in stocks of refined copper. Consumers felt that the figures might affect the attitude of sellers. Producers, on the other hand, took the stand that consumers are very much underbought and that the stocks of refined in first hands merely reflect this condition. In other words, just as soon as business picks up the stocks should decrease rapidly.

All of the business booked during the week for domestic account, which amounted to only several hundred tons a day, was placed at 18c. per pound, delivered in Connecticut. Demand was mostly for prompt copper, though more than one lot sold for January shipment. In the Middle West the market held at 18⅛c.

Export demand was a little more in evidence than earlier in the month. On Tuesday about 2,450 tons were purchased for export, of which some 900 tons went to Russia. Foreign sales since the first of the month totaled about 9,200 tons. Copper Exporters, Inc., quote 18.30c. per pound, c.i.f. usual European ports.

### Daily Prices of Metals

| Dec. | Electrolytic Copper | Straits Tin | Lead | | Zinc |
|---|---|---|---|---|---|
| | Refinery | New York | New York | St. Louis | St. Louis |
| 5 | 17.775 | 38.375 | 6.25 | 6.10 | 5.90@6.00 |
| 6 | 17.775 | 38.375 | 6.25 | 6.10 | 5.90@6.00 |
| 7 | 17.775 | 38.50 | 6.25 | 6.10 | 5.90@6.00 |
| 9 | 17.775 | 39.625 | 6.25 | 6.10 | 5.90@6.00 |
| 10 | 17.775 | 39.625 | 6.25 | 6.10 | 5.80@5.90 |
| 11 | 17.775 | 39.50 | 6.25 | 6.10 | 5.80@5.90 |
| | 17.775 | 39.000 | 6.250 | 6.100 | 5.917 |

Average prices for calendar week ended December 7, 1929, are: Copper, 17.775c.; Straits tin, 38.729c.; New York lead, 6.250c.; St. Louis lead, 6.100c.; zinc, 5.958c.; and silver, 49.354c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East are 1@1.15c., depending upon purity, above St. Louis prices for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

### London

| Dec. | Copper | | Electrolytic | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | | | | | | | |
| | Spot | 3M | | Spot | 3M | Spot | 3M | Spot | 3M |
| 5 | 68¾ | 68⅝ | 83 | 174 | 177¼ | 21 5/16 | 21½ | 20¾ | 21 |
| 6 | 68½ | 68 | 83 | 173½ | 176½ | 21 5/16 | 21 7/16 | 20⅝ | 20¾ |
| 9 | 68⅝ | 68 7/16 | 82 | 177½ | 180¾ | 21⅜ | 21½ | 20 5/16 | 20 7/16 |
| 10 | 68½ | 68½ | 82 | 181 | 184½ | 21 5/16 | 21 7/16 | 20 3/16 | 20 5/16 |
| 11 | 68⅝ | 68⅝ | 82 | 179¾ | 182¾ | 21⅜ | 21½ | 20⅝ | 20¾ |

Prices for lead and zinc are the official closing prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

### Silver, Gold, and Sterling Exchange

| Dec. | Sterling Exchange "Checks" | Silver | | Gold London | Dec. | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 5 | $4.87 3/16 | 49⅛ | 22⅛ | 84s11 1/2d | 9 | $4.87¾ | 49½ | 22⅝ | 84s11½d |
| 6 | 4.87⅛ | 49⅛ | 22⅛ | 84s11½d | 10 | 4.87 1/16 | 49¼ | 22⅜ | 84s10½d |
| 7 | 4.87 1/16 | 49⅛ | 22 1/16 | ..... | 11 | 4.87¼ | 49⅛ | 22⅝ | 84s11d |

Average: Silver, 49.438c.; Sterling Exchange, $4.8770

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

### Good Sales of Lead

Lead again was the high spot from the standpoint of total volume of business done. Sales approached the 6,000-ton mark, which is more than an average week's business. With production curtailed in more than one direction, and consumption holding at a good level, the market appears to be in a firm position. American Smelting & Refining continues to quote 6.25c. per pound, New York. In St. Louis the market was maintained at 6.10c. The London market was irregular, but showed little net change for the week. Severe storms in England were believed here to have disrupted business in that quarter temporarily. Consumption of lead on the Continent is holding up well for this time of the year.

Domestic consumers, taken as a whole, bought liberally in the last week, most of the demand being for December and January shipments. Several lots sold for February shipment. Most sellers were not inclined to quote on the more distant position. Ammunition makers, cable manufacturers, and corroders were well represented in purchases made. Battery makers also took on some additional tonnage, despite the reported slackening in activity in the automobile industry. The sustained demand for lead from battery makers is attributed to the excellent demand for storage batteries for replacement purposes.

From present indications shipments of lead to consumers in December will approximate 50,000 tons, a satisfactory total for the last month in the year.

### Zinc Prices Unsettled

Zinc sold during the week at prices ranging from 5.80c. to 6c. per pound, with offerings at the inside figure noted

at the close. Despite the recent decline in prices the demand from consumers remains subnormal. Developments in connection with the European cartel are attracting a good deal of attention, and in producing circles it is hoped that something may yet come out of the deliberations of the committee appointed to bring order out of the chaotic conditions now obtaining. As matters stand the cartel will disband after Dec. 31. The November statistics revealed a further accumulation in stocks in the hands of domestic producers, the increase amounting to some 5,945 tons contrasted with the October figures.

## Tin Buyers Shy

The market for tin was extremely quiet throughout the week. In London prices fluctuated over a wider range, largely on the strength of operations by the group. Consumers here refused to come into the market except for near-by wants, and it is apparent that they are following developments in the domestic automotive industry to a greater extent than all the talk about regulating production. Straits shipments of tin in the first eleven months of the current year amounted to 93,069 tons, against 89,853 tons in the corresponding period last year.

## Silver Weak and Inactive

With the exception of a slight rally on two days, which was apparently caused by the purchase of a substantial amount of silver by the United States government, the silver market has continued its sagging tendency. Buying for China account has been the chief factor, but without competitive buying from other sources there is little likelihood of any improvement in prices.

*Mexican Dollars* (old Mexican pesos): Dec. 5th, 36½c.; 6th and 7th, 36¼c.; 9th, 36⅝c.; 10th, 36½c.; 11th, 36⅜c.

## Foreign Exchange

Closing cable quotations on the principal Continental exchanges on Tuesday, Dec. 10, were: Francs, 3.93⅛c.; lire, 5.23¾c.; and marks, 23.95½c. Canadian dollars $\frac{3}{32}$ per cent discount.

## Other Metals

**Quotations cover large wholesale lots unless otherwise specified**

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 8½c. per lb. for spot and 8⅜c. per lb. for future delivery. Market quiet, but in the absence of news from China prices are fairly steady. Cookson's "C" grade, spot, 14c.

BISMUTH—Per lb., New York, in ton lots, $1.70.

CADMIUM — Per lb., New York: 80@90c. Inside price named on contract business.

IRIDIUM—Per oz., $200@$210 for 98@99 per cent sponge and powder.

NICKEL — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $35@$37. Small lots bring up to $46.

PLATINUM — Official price quoted by the leading interest on small orders for refined metal is $63 per oz. Transactions between dealers and refineries in the outside market are reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $122@$123.50. Demand quiet and prices are unsettled. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of Dec. 7.

## Metallic Ores

TUNGSTEN ORE—Per unit of $WO_3$, N. Y.: Wolframite, $15.25@$15.35 for future shipment. Inquiry shows slight improvement, and with offerings moderate prices held on a steady basis. A sale of domestic scheelite was made at $16.50 for 1930 delivery. Bolivian scheelite, $15.25, Dec.-Jan. shipment. Western scheelite, $16.50 for Jan. shipment.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Dec. 7 issue.

## Tri-State Concentrate Prices Unchanged

*Joplin, Mo., Dec. 7, 1929*

| Blende | | Per Ton |
|---|---|---|
| High | | $42.50 |
| Primium blende, basis 60%.. | | 38.00 |
| Prime Western, basis 60%.. | $37.00@ | 38.00 |
| Table concentrate | 36.00@ | 37.00 |
| Flotation concentrate | 36.00@ | 37.00 |
| Average settling price | | 39.60 |
| **Galena** | | |
| High | | $78.60 |
| Basis 80% lead | | 75.00 |
| Average settling price | | 76.70 |

Shipments for the week: Blende, 7,807; lead, 1,555 tons. Value, all ores the week, $427,450.

The lower slab zinc market did not affect zinc concentrate prices. The market was steadied and strengthened by an improved demand.

This is the first December in several years that smeltermen have failed to enlarge materially both purchases and shipments at the close of the year. It was done in former years to clear the bins in Oklahoma, so as to relieve producers of the high tax on concentrate in the bins Dec. 31. Relief has been attained this year by a tax rate adjustment.

Production for eleven months of 1929 was 572,820 tons of zinc concentrate. Of this total 134,400 tons was the product of flotation units.

*Platteville, Wis., Dec. 7, 1929*

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60% zinc | $40.50 |
| **Lead Ore** | |
| Lead, basis 80% | $75.00 |

Shipments for the week: Blende, 547 tons; lead, 40 tons. Shipments for the year: Blende, 31,346; lead, 1,975 tons. Shipments for the week to separating plants, 1,345 tons blende.

## Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Dec. 7 issue.

## Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Good demand and price is steady.

SODIUM NITRATE — Per 100 lb., $2.12 for prompt delivery.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Dec. 7 issue.

## Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $100. Spiegeleisen, 19@21 per cent, $34 f.o.b. furnace on carload business.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.45 f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the Dec. 7 issue.

## Rolled Metals

Copper, lead, zinc, Monel metal, nickel sheets, and copper wire are unchanged from prices in the Dec. 7 issue.

## Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Dec. 7.

## Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces: Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL — Base prices per gross ton, Pittsburgh, billets and slabs, $35; plates, structural shapes, and soft steel bars, per 100 lb., $1.90@$1.95.

COKE — Per gross ton, Connellsville furnace, $2.65@$2.70. Connellsville foundry, $3.50@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis), $6.50; Buffalo and Detroit, $8.50@$9.

# Mining Stocks—Week Ended December 7, 1929

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Anaconda Copper | New York | 80⅛ | 75½ | 80⅛ | Oc. 11 No. 18 Q | 1.75 |
| Andes Copper | New York | 36½ | 33½ | 35½ | Oc. 11 No. 11 Q | 0.75 |
| Arizona Com | Boston | 1½ | 1½ | 1½ | Jl. 16 Jl. 31 SA | 0.25 |
| Calumet & Ariz | New York | 94½ | 86 | 90 | De. 6 De. 23 Q | 2.50 |
| Calumet & Hecla | New York | 34½ | 32½ | 33½ | No. 30 De. 31 Q | 1.50 |
| Cerro de Pasco | New York | 66½ | 62½ | 65½ | Oc. 10 No. 1 Q | 1.50 |
| Con. Coppermines | N. Y. Curb | 6 | 5⅜ | 5⅜ | | |
| Copper Range | Boston | 17⅜ | 16½ | 16½ | De. 14, Ja. 15 Q | 0.50 |
| East Butte | Boston | 2 | 1½ | 1⅜ | No. 20, De. 21 | 0.25 |
| Granby Con | New York | 58⅜ | 53 | 56½ | Oc. 18 No. 1 Q | 2.00 |
| Greene Cananea | New York | 118 | 116 | 118 | De. 12 Ja. 6 Q | 2.00 |
| Howe Sound | New York | 38½ | 36 | 37⅜ | Se. 30 Oc. 15 Q | 1.00 |
| Hudson Bay | N. Y. Curb | 10⅜ | 9⅜ | 10 | | |
| Inspiration | New York | 31½ | 28½ | 31 | De. 19 Ja. 6 Q | 1.00 |
| Isle Royale | Boston | 16 | 15 | 15 | No. 30, De. 31 Q | 0.50 |
| Kennecott | New York | 62½ | 56⅜ | 61⅜ | No. 29, Ja. 2 Q | 1.25 |
| Magma Copper | New York | 52⅜ | 46½ | 51⅜ | Se. 30, Oc. 15 Q | 1.25 |
| Mason Valley | N. Y. Curb | | | 2 | | |
| Miami Copper | New York | 29½ | 27½ | 29 | No. 1, No. 15 Q | 1.00 |
| Mohawk | Boston | 49 | 44 | 44 | Oc. 3, De. 2 | 3.00 |
| Mother Lode | New York | 2½ | 2 | 2⅛ | De. 9, De. 31 | 0.20 |
| Nevada Con | New York | 32½ | 29⅜ | 31½ | De. 13, De. 31 Q | 0.75 |
| Noranda | N. Y. Curb | 36⅜ | 33⅜ | 36 | De. 10, Ja. 2 Q | 0.75 |
| Ohio Copper | N. Y. Curb | 1½ | 1⅜ | 1⅜ | Sept., 1926 | 0.03 |
| New Dominion | Boston | 7½ | 6½ | 6½ | Dec., 1918 | 1.00 |
| Phelps Dodge | New York | 41½ | 38½ | 40½ | De. 6, Ja. 2 Q | 0.75 |
| Quincy | Boston | 20½ | 18 | 19⅜ | March, 1920 | 1.00 |
| Roan Antelope | N. Y. Curb | 30½ | 28½ | 29⅜ | | |
| St. Mary's M. L. | Boston | 26⅜ | 25½ | 25½ | No. 29, De. 10 | 1.00 |
| Seneca Copper | New York | 2½ | 2½ | 2⅜ | | |
| Shattuck Denn | N. Y. Curb | 11⅛ | 8½ | 11½ | | |
| Sheritt-Gordon | Toronto | 3.65 | 3.40 | 3.45 | | |
| Tenn. C. & C. | New York | 13½ | 12½ | 13 | No. 30, De. 16 Q | 0.25 |
| United Verde Ex. | N. Y. Curb | 13½ | 13⅛ | 13⅛ | Oc. 2, No. 1 Q | 1.00 |
| Utah Copper | New York | | | 224½ | D. 13, De. 31 QX | 8.00 |
| Waite-Ack.-Mont. | Toronto | 3.75 | 3.50 | 3.75 | | |
| Walker Mining | Salt Lake | 4.25 | 3.70 | 4.25 | | |
| Wenden Copper | N. Y. Curb | *87½ | *68½ | *75 | | |
| **LEAD, ZINC, SILVER** | | | | | | |
| Ahumada Lead | New York | 1.00 | *75 | *75 | | |
| Amer. Z. L. & S. | New York | 11⅞ | 9⅜ | 11 | May, 1917 | 1.00 |
| A. Z. L. & S., pfd. | New York | 62 | 59 | 62 | De. 12, Ja. 1 Q | 1.50 |
| Bunker Hill & S. | N. Y. Curb | 105 | 105 | 105 | No. 29, De. 5 X | 0.50 |
| Butte Cop. & Zn. | New York | 4½ | 4 | 4⅛ | De. 10, De. 25 | 0.50 |
| Butte Cop. Con. | Boston Curb | | | 31⅛ | | |
| Butte & Sup. | New York | 6½ | 5⅞ | 6⅜ | De. 13, De. 31 Q | 0.50 |
| Callahan Zn-Ld. | New York | 1⅛ | 1⅛ | 1⅛ | Dec., 1920 | 0.50 |
| Chief Consol. | Salt Lake | 1.95 | 1.85 | 1.95 | Fe. 1, 1918 K | 0.10 |
| Consol. Ld. & Zn. "A" | St. Louis | 7⅛ | 7 | 7 | Se. 20, Oc. 1 Q | 0.25 |
| Constitution | Spokane | | | *38⅛ | | |
| Dayrock | Spokane | | | 1.98 | Je. 20, Je. 30 | 0.03 |
| Dickens Consol. | Spokane | | | *4½ | | |
| Eagle-Picher | Cincinnati | 14 | 13⅛ | 13⅛ | Se. 30, Oc. 15 Q | 0.20 |
| Eagle-Pich., pfd. | Cincinnati | | | 101 | Se. 30, Oc. 15 Q | 1.50 |
| Erupcion | Boston Curb | | | *12 | Jan. 1, 1928 | 0.07½ |
| Eureka Bullion | Salt Lake | *48 | *40 | *48 | | |
| Evans-Wallower | N. Y. Curb | 5⅜ | 4⅜ | 5 | | |
| Evans-Wal., pfd. | N. Y. Curb | | | 80 | Je. 20, Jl. 1 Q | 1.75 |
| Federal M. & S. | New York | | | 190 | June, 1927 | 10.00 |
| Fed. M. & S., pfd. | New York | | | 98½ | No. 25, De. 16 Q | 1.75 |
| Gladstone | Spokane | | | *1½ | | |
| Golconda | Spokane | | | *76½ | Je. 15, Jl. 1 | 0.02 |
| Grandview | Spokane | | | *23 | | |
| Hecla Mining | N. Y. Curb | 14½ | 14 | 14½ | No. 15, De. 15 Q | 0.25 |
| Highland-Surprise | Spokane | | | *8 | | |
| Jack Waite | Spokane | | | *8½ | | |
| Kootenay Florence | Spokane | | | *8½ | | |
| Lucky Jim | Spokane | | | *6 | | |
| Lucky Tiger-C. | Kansas City | | †2.25 | | No. 9, No. 20 M | 0.02½ |
| Mexican Premier | Spokane | | | 1.87 | | |
| National Lead | New York | 153½ | 140 | 153⅜ | De. 13, De. 31 Q | 1.25 |
| Natl. Lead, pfd. A | New York | 139 | 138 | 139 | Nv. 29, De. 14 Q | 1.75 |
| Natl. Lead, pfd. B | New York | 118½ | 116 | 116 | Je. 17, Fe. 1 Q | 1.50 |
| N. J. Zinc, new | N. Y. Curb | 69½ | 66½ | 66½ | No. 20, De. 10 X | 0.50 |
| New Quincy | Salt Lake | 1.00 | *70 | *82 | Se. 20, Se. 30 Q | 0.10 |
| Noble Five | Spokane | | | *40 | | |
| North Lily | Salt Lake | 3.75 | 3.20 | 3.25 | Oc. 16, Oc. 23 | 0.25 |
| Park Bingham | Salt Lake | *6 | *4⅜ | *5 | | |
| Park City Con. | Salt Lake | | | 1.00 | | |
| Park Utah | New York | 3½ | 3½ | 3½ | Dividends suspended | |
| Pend Oreille | Spokane | | | 3.00 | | |
| Rico Argentine | Salt Lake | *16 | *16 | *16 | No. 30, De. 15 Q | 0.03 |
| Ruth-Hope | Spokane | | | *20 | | |
| St. Joseph Lead | New York | 57½ | 46 | 57½ | Se. 10, Se. 20 QX | 0.75 |
| Sherman Lead | Spokane | | | *38 | | |
| Silver King Coa. | Salt Lake | 10.75 | 10.00 | 10.75 | Se. 20, Oc. 1 Q | 0.25 |
| Silversmith | Spokane | | | 6¾ | Oct., 1926 | 0.02 |
| Sunshine Mining | Spokane | | | 5.00 | Se. 10, Se. 20 Q | 0.05 |
| Tamarack-Custer | Spokane | | | *43 | Sept., 1924 | 0.25 |
| Tintic Standard | Salt Lake | 11.00 | 10.50 | 11.00 | Se. 17, Se. 20 X | 0.30 |
| Tonopah Belmont | N. Y. Curb | | | *37½ | Oct., 1925 | 0.05 |
| Treadwell-Yukon | Toronto | 7.00 | 7.00 | 7.00 | | |
| United Zinc Smg, New | N. Y. Curb | | | 7 | | |
| Utah Apex | Boston | 3⅛ | 3 | 3⅛ | Oc. 15, No. 1 | 0.25 |
| Utah Met. & Tun. | Boston | *73 | *68 | *68 | Dec., 1927 | 0.30 |
| Whitewater | Spokane | | | | | |
| Yellow Pine | Los Angeles | | | *8 | Dec., 1925 | 0.04 |
| **GOLD** | | | | | | |
| Alaska Juneau | New York | 7⅛ | 5⅛ | 7⅛ | | |
| Barry-Hollinger | Toronto | *17 | *15 | *15½ | | |
| Central Manitoba | Toronto | *25 | *22 | *25 | | |
| Cresson Consol. | N. Y. Curb | *43¾ | *37½ | *37½ | De. 31, Ja. 10 Q | 0.02 |
| Dome Mines | New York | 7⅞ | 6⅞ | 7⅛ | De. 31, Ja. 20 Q | 0.25 |
| Golden Cycle | Col. Springs | †15.25 | †14.50 | | No. 30, De. 10 | 0.40 |
| Hollinger | Toronto | 5.15 | 5.00 | 5.15 | No. 15, De. 2 FW | 0.05 |
| Homestake | New York | 80 | 80 | 80 | No. 20, No. 25 M | 0.50 |
| Kirkland Lake | Toronto | *60 | *55 | *55 | | |
| Lake Shore | Toronto | 20.80 | 19.25 | 20.25 | De. 2, De. 16 Q | 0.30 |
| McIntyre Porcupine | New York | 14½ | 14¼ | 14½ | Nv. 1, De. 2 Q | 0.25 |
| Portland | Col. Springs | †*8 | †*5 | | April, 1927 | 0.01 |
| Rand Mines | New York | | | 25 | Au. 21, 29 A.s. | 1.50 |
| Siscoe | Toronto | *57 | *50 | *50 | | |
| Sylvanite | Toronto | *50 | *46 | *50 | | |
| Teck-Hughes | Toronto | 5.30 | 5.05 | 5.15 | Ja. 17, Fe. 1 Q | 0.15 |
| Tom Reed | Los Angeles | *57 | *53 | *53 | Dec., 1926 | 0.02 |
| Unity Gold | N. Y. Curb | *75 | *50 | *50 | | |
| Vipond Consol. | Toronto | *65 | *62 | *65 | April, 1927 | 0.03 |
| Wright-Hargreaves | Toronto | 1.32 | 1.25 | 1.30 | Oc. 16, No. 1 | 0.02½ |
| Yukon-Alaska | N. Y. Curb | | | 35¼ | | |
| **GOLD AND SILVER** | | | | | | |
| Carnegie Metals | N. Y. Curb | 8¾ | 5¼ | 5¼ | | |
| Castle-Trethewey | Toronto | *29 | *28 | *28 | | |
| Consol. Cortez | N. Y. Curb | | | *6½ | | |
| Dolores Esperanza | N. Y. Curb | *25 | *12½ | *12½ | July, 1923 | 0.05 |
| Keeley | Toronto | *37 | *34½ | *37 | Mr. 15, 1928 | 0.04 |
| Mining Corp. | Toronto | 3.30 | 3.10 | 3.10 | De. 4, De. 19 | 0.12½ |
| Montana-Mines Corp. | Spokane | | | *36½ | | |
| N. Y. & Hond. Ros. | N. Y. Curb | 15½ | 15 | 15½ | Oc. 16, Oc. 26 QX | 0.50 |
| Nipissing | N. Y. Curb | 1⅞ | 1⅜ | 1⅜ | De. 31, Ja. 20 Q | 0.07½ |
| Premier Gold | N. Y. Curb | 1⅛ | 1⅛ | 1⅛ | De. 11, Ja. 4 Q | 0.06 |
| Tonopah Exten. | N. Y. Curb | | | *10 | April, 1925 | 0.05 |
| Tonopah Mining | N. Y. Curb | | | 2½ | Se. 30, Oc. 21 | 0.07½ |
| United Eastern | N. Y. Curb | | | *18⅜ | | |
| Yukon Gold | N. Y. Curb | *56¼ | *56¼ | *56¼ | June, 1918 | 0.02 |
| **IRON AND STEEL** | | | | | | |
| Bethlehem Steel | New York | 97 | 88½ | 97 | Jan. 18, Fe. 15 Q | 1.50 |
| Beth. Steel, pfd, 7%. | New York | 125 | 122½ | 123 | De. 7, Ja. 2 Q | 1.75 |
| Cleveland-Cliffs | Cleveland | 94 | 93 | 93 | Se. 5, Se. 15 Q | 1.00 |
| Colo. Fuel & Iron | New York | 39⅞ | 31½ | 39¾ | | |
| Colo. F. & I., 1st pfd. | New York | 126 | 126 | 126 | No. 10, No. 1 Q | 2.00 |
| Great Northern Iron. | New York | 25½ | 22 | 22 | Dec. 15 K | 2.00 |
| Inland Steel | New York | 76 | 72½ | 76 | No. 15, De. 1 Q | 0.87½ |
| Republic I. & S. | New York | 85⅞ | 70 | 85⅝ | No. 12, De. 2 Q | 1.00 |
| Republic I. & S. pfd. | New York | 106 | 105 | 106 | De. 12, Ja. 2 Q | 1.75 |
| Sloss-Sheffield S. & I. | New York | 43½ | 33 | 43½ | Mr. 11, Mr. 20 Q | 1.50 |
| Sloss-Sheff. S.&I., pfd. | New York | 75 | 67 | 75 | De. 20, Ja. 2 Q | 1.75 |
| U. S. Steel | New York | 183½ | 159½ | 182⅝ | No. 30, De. 30 QX | 2.75 |
| U. S. Steel, pfd. | New York | 141½ | 140⅝ | 141½ | No. 2, No. 29 Q | 1.75 |
| Virginia I. C. & C. | New York | 19⅝ | 19 | 19⅝ | Jan., 1924 | 1.50 |
| Virginia I.C.&C., pfd. | New York | 40 | 40 | 40 | Jl. 16, 1928 SA | 2.50 |
| **MISCELLANEOUS** | | | | | | |
| Aluminum Co. of Am. | N. Y. Curb | 290 | 240 | 290 | | |
| Alum. Co. of Amer., pf. | N. Y. Curb | 108½ | 106 | 108½ | De. 14, Ja. 1 Q | 1.50 |
| American Metal | New York | 49½ | 41½ | 49½ | No. 20, De. 2 Q | 0.75 |
| Amer. Metal, pfd., 6% | New York | 112 | 112 | 112 | No. 20, De. 2 Q | 1.50 |
| Amer. Sm. & Ref. | New York | 76⅞ | 70 | 76 | Oc. 11, No. 1 Q | 1.00 |
| Amer. Sm. & Ref., pfd. | New York | 135 | 134 | 134 | No. 1, De. 2 Q | 1.75 |
| Ang. Ch. Nitrate | N. Y. Curb | 23 | 21½ | 22 | | |
| Asbestos Corp. | Montreal | 3 | 2½ | 3 | Jan., 1926 | 1.50 |
| Asbestos Corp., pfd. | Montreal | 12 | 11 | 12 | De. 31, Ja. 15 Q | 1.75 |
| Consol. M. & S. | Montreal | 275 | 270 | 271 | Je. 29, Jl. 15 SA | 6.25 |
| De Beers Consol. | New York | | | 21 | Jl. 23, Jl. 26 Q | 0.96 |
| Federated Metals | N. Y. Curb | | | 25 | Oc. 3, Oc. 11 Q | 0.25 |
| Freeport Texas | New York | 37 | 33⅜ | 36⅝ | Oc. 15, No. 1 Q | 1.00 |
| Int. Nickel Can. | New York | 33⅜ | 28⅜ | 32⅜ | No. 30, De. 31 Q | 0.25 |
| Int. Nickel, pfd. | New York | 118 | 116½ | 118 | Se. 28, No. 1 Q | 1.75 |
| Mayflower Assoc. | N. Y. Curb | 52⅞ | 50 | 52½ | | |
| Metal & Mining | N. Y. Curb | 10⅜ | 8⅜ | 9½ | Se. 21, Oc. 1 | 0.30 |
| Newmont | N. Y. Curb | 128 | 116½ | 123 | Se. 30, Oc. 15 Q | 1.00 |
| Patino M. & E. | New York | 31⅞ | 29⅜ | 30⅛ | De. 7, De. 24 | 4s. |
| So. America G. & P. | N. Y. Curb | 1½ | 1⅜ | 1½ | | |
| Texas Gulf Sulphur | New York | 59⅜ | 56½ | 59 | De. 2, De. 16 Q | 1.00 |
| U. S. Sm. R. & M. | New York | 39½ | 36½ | 39 | Oc. 7, Oc. 15 Q | 0.87½ |
| U. S. Sm. R. & M., pfd | New York | 51½ | 51 | 51 | Oc. 7, Oc. 15 Q | 0.87½ |
| Vanadium Corp. | New York | 60⅜ | 50⅜ | 59½ | Nv. 1, Dc. 16 QX | 1.75 |

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I Initial. R, Respumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. A.s., American shares.

**LONDON QUOTATIONS—WEEK ENDED November 26, 1929**

| | High | Low | Last | Date | Amount |
|---|---|---|---|---|---|
| Alaska Mexican ($5) | 12/6 | 12/6 | 12/6 | | |
| Alaska Treadwell ($25) | 60/— | 60/— | 60/— | Nov., 1926 | 4 p.c. |
| Aramayo Mines (25 frs.) | 41/10½ | 37/6 | 40/— | Nov., 1929 | 5 p.c. |
| Burma Corpn. (10 rupees) | 17/3 | 16/9 | 17/1½ | July, 1929 | 9 annas* |
| Bwana M'Kubwa (5s) | 22/7½ | 18/— | 20/3 | | |
| Camp Bird (2s) | 1/7½ | 1/4½ | 1/6 | April, 1928 | 16⅔ p.c. |
| El Oro (5s) | 3/4½ | 2/1½ | 2/6 | Nov., 1929 | 20⅚ p.c.* |
| Frontino & Bolivia (£1) | 7/9 | 7/9 | 7/9 | Jan., 1929 | 3⅓ p.c. |
| Mexican Corpn. (£1) | 12/3 | 11/10½ | 12/— | Oct., 1929 | 10 p.c. |
| Mexico Mines of El Oro (£1) | 3/9 | 2/6 | 3/1½ | Dec., 1926 | 3⅓ p.c.* |
| Mount Isa (£1) | 27/6 | 25/— | 26/3 | | |
| N'Changa Copper Mining (£1) | 40/— | 26/3 | 26/3 | | |
| Oroville Dredging (4s) | 1/6 | 1/4½ | 1/6 | Nov., 1928 | 31¼ p.c. |
| Rhodesian Congo Border (£1) | 142/6 | 121/3 | 125/— | | |
| St. John del Rey (£1) | 17/— | 15/9 | 16/6 | Dec., 1929 | 2½ p.c. |
| San Francisco Mines (10s) | 30/3 | 27/9 | 28/1½ | June, 1929 | 15 p.c. |
| Santa Gertrudis (£1) | 11/9 | 10/7½ | 11/9 | July, 1929 | 7½ p.c. |
| Selukwe (2s. 6d.) | 5/6 | 4/3 | 4/6 | April, 1917 | 6¼ p.c. |
| S. Amer. Copper (2s) | 1/9 | 1/4½ | 1/6 | Nov., 1917 | 75 p.c. |
| Tanganyika (£1) | 45/— | 40/7½ | 41/3 | July, 1929 | 7½ p.c. |
| Union Miniere du Haut-Katanga (Brussels) | 9,800 | 9,350 | 9,350 | April, 1929 | 300 fr. (‡) |

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation.